

## THE PSYCHOLOGICAL REVIEW

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### BELIEF AS A DERIVED EMOTION

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The *psychology of belief* presents three main problems which may with advantage be sharply distinguished, though they cannot be discussed in entire separation: (1) the problem of the conditions which engender belief; (2) the nature of that state which we call holding a belief, a state which continues when the topic concerned is not present to consciousness; (3) the problem of the nature and proper classification of belief as a mode of being conscious, a quality of experience which qualifies our thinking of that in which we believe. It is the last problem that I propose chiefly to discuss in this paper, and to which I hope to suggest an answer more satisfactory than any that may be found in the books. A true answer to this should help to a fuller understanding of the other two problems. What then is the nature of that peculiar mode of being conscious which we call belief? That belief is a distinct quality of experience we realize if we compare it with our state of simple imagination of some event, or with one of doubt about it; say a past event: Did you lock the door? If you are in no way interested in the door's being locked or unlocked the question leaves you indifferent. You may perhaps imagine the door and yourself beside it turning the key; and this imagination may be qualified by neither belief nor doubt. But if you are keenly interested in the fact questioned; if, that is to say, you desire that the door be either locked or unlocked, your thinking of the act will issue in, or be qualified by, either belief or doubt.

Belief is the normal result of judgment in reply to a question of fact. But, though resulting from judgment, it is not to be identified with it—with *affirmation* or *denial*; judgment is an act; belief is an enduring state resulting from judgment. Some authors have put this mode of consciousness apart from all others as unique, separate, having nothing in common with any other. Others recognize it as a mode of feeling, or as an emotion. There is no other recognized category for it; and, as I hope to show, it is allied, both in its nature and in respect to the conditions which determine it, with a group of universally recognized emotions, modes of experience to which common speech unhesitatingly assigns the status of emotions.

I feel sure, then, that those are right who have classed belief as an emotion—Bagehot, *e.g.*, when he spoke of 'the emotion of conviction,' and James when he wrote that the emotions of belief and doubt are perfectly distinct, though perfectly indescribable in words; or when he wrote, "In its inner nature, belief . . . is a sort of feeling more allied to the emotions than to anything else" ('Principles,' p. 283, II.). But if so, what kind of an emotion is it? What is its relation to other emotions? How shall we classify it? What are its nearest relatives among the emotions? We may first enquire,—Is it a *primary emotion*? It is worthy of note in this connection that James did not attempt to apply his famous theory of the emotions to this particular case, did not attempt to point out what visceral or bodily sensations enter into the composition of belief. And we may safely suppose that, if he had done so, he would have realized that 'belief', although rightly called by him an emotion, stands apart from the primary emotions, for the explanation of which his famous theory was formulated and in respect of which it is so plausible and persuasive. For even James's ingenuity would have failed, I think, to resolve belief into any cluster of visceral or kinesthetic sensations.

If we put aside the James-Lange theory as unproven, we must still recognize that the primary emotions, the fundamental types of emotion, such as anger, fear, and disgust,

which are universally recognized as such, have their characteristic bodily expressions, their specific motor attitudes of face, limbs, and trunk, and their specific visceral innervations. And we shall look in vain for any such characteristic bodily expression of belief. Accordingly, the actor has no difficulty in portraying those primary emotions; but could the most skilful actor portray the emotion of belief? What facial expression, what posture of the limbs, what respiratory, circulatory or glandular changes would aid him in this task? Would he not confess the task set him to be impossible of achievement?

It is, I think, mainly for this reason that so few psychologists have explicitly admitted belief to the class of emotions. For, though the view that the primary emotions are expressions in consciousness of the operation of primary impulses or instinctive tendencies has not yet been generally accepted, the fact that these emotions have their specific bodily expressions, specific innervations of the skeletal muscles and visceral organs, is too familiar to be overlooked, too obvious to be denied. And such bodily expression or resonance is commonly accepted, apart from all theory, as the mark, if not the essence, of an emotion.

But, though 'belief' differs from the primary emotions in this important respect, it seems to resemble them and claim membership in their class by reason of another fact. It is generally recognized that the primary emotions impell us strongly to action, or, as I prefer to say, accompany the working in us of strong impulses to action, the instinctive impulses. Now it has often been pointed out that belief seems to have a similar function, a power of impelling us to action. This is recognized by common speech in such phrases as 'the power of conviction'; 'the uplifting power of faith'; 'the strength that comes from belief,' and so on. And it has been much insisted on by some psychologists—notably Bain.

This view, that belief or conviction is a power or conative force, was implied in that old-fashioned theory of 'suggestion' according to which suggestion consisted essentially in pro-

ducing a condition of 'mono-ideism,' the undisputed prevalence in consciousness of some one idea. Such an idea, being unhampered by rival ideas, it was said, is accepted with a conviction that gives it unlimited power to determine action or thought, and which, reaching its extreme in the hypnotic state, enables an idea to produce even profound organic changes in the body, such as blistering, or the mysterious but well accredited stigmata. Further study of the process of suggestion and of the so-called fixed ideas of mental pathology has shown, however, that this theory of suggestion, together with the ideo-motor theory of which it was both a product and a main support, was fallacious, that it was founded in the intellectualist error that was so widely prevalent in philosophy and psychology in the 19th century, the error of ignoring all the active or conative side of man's nature. We see now that the conative energy which in 'suggestion' was attributed to belief is really the same conative energy which establishes the belief; that the process of suggestion depends for its success on the evocation of a conative energy, and that the belief established by suggestion is an effect rather than a cause, an incident or phase in the sequence of events constituting the process of suggestion, a sequence which, like every other mental process, is sustained by some conative energy seeking its natural end. This ground for classing belief with the primary emotions is therefore fallacious.

Each primary emotion, or the instinctive impulse with which it is associated, has its natural goal or specific end toward which it strives and in the attainment of which it achieves satisfaction. But it is impossible to assign any such specific end to belief. Belief is an end in itself rather than a striving for some other end, it is a *terminus ad quem* rather than a driving power. And in so far as farther action, bodily or mental, succeeds to belief, there is nothing specific about it; for the ends towards which we strive, sustained as we say popularly by belief or faith, may be of every possible kind.



If belief is not a primary emotion, neither can it be classed with the compound emotions, such as admiration, awe, or reproach, which seem to be formed by the blending of two or more of the primary emotions. The arguments which forbid our classing it with the primaries apply here also; and there is the further objection that it is impossible to analyze it introspectively, or in any other way display it as a blend of any of the primaries. If, then, belief is an emotion, but is neither a primary emotion nor a blend of primary emotions, what sort of an emotion is it? Is there any class of emotions to which it has affinities of nature, and which it resembles in respect of the conditions by which it is engendered?

Yes, there is such a class; a group of emotions, which have been unduly neglected by psychologists, and which have only recently been brought into prominence by attempts to give some systematic account of their nature, genesis, and relations. I refer to those emotions which Mr. Shand has brought together under the head of prospective emotions of desire.<sup>1</sup> I do not agree altogether with Mr. Shand's treatment of this group and I would enlarge the class by adding several members not included by him. I submit that 'belief' belongs to that class of emotions which I have recently discussed under the heading, 'the derived emotions'.<sup>2</sup> The principal members of this class are confidence, hope, anxiety, despondency, despair, and regret. I have argued that all these 'derived' emotions are members of, or named points in, a continuously graded scale of emotional experiences which may accompany and qualify the operation of any strong desire. When such desire works towards its goal unhampered by any thought of the possibility of failure and by the painful feeling that any such thought must bring, the emotional state is one of *confidence*. When some circumstance suggests or indicates a faint possibility of failure, the emotional state changes from *confidence* to *hope*; if the possibility of failure is more strongly indicated, *hope* changes to *anxiety*, the

<sup>1</sup> 'Foundations of Character.'

<sup>2</sup> In the new edition of my 'Social Psychology.'

whole train of activity being more strongly coloured by the painful feeling which inevitably accompanies the anticipation of failure. When the mere possibility of failure becomes a clear probability, the emotional state changes to *despondency*; and when that probability becomes a certainty, *despondency* becomes *despair*. Finally, when the failure is completely established, when the possibility of success lies wholly in the past, our attitude is no longer one of prospective desire, but becomes retrospective; we experience a thwarted and therefore painful retrospective desire, which is *regret*.<sup>1</sup>

It may perhaps be questioned whether we can properly regard these states as emotions; but to deny them the status of emotions would be to fly in the face of generally accepted and long established usage of language. No emotion is more generally recognized as such in common speech, or more widely celebrated and personified by the poets, than the emotion of *hope*. And if we admit *hope* to be properly regarded as an emotion, we can hardly refuse to admit to the same class those other members of this closely allied group of experiences. The attitudes and expressions of these emotions are not specific in the same way as those of the primaries and cannot be portrayed by the actor with the same precision and without ambiguity.

These emotions, then, are determined by our intellectual apprehension of the degrees of probability of the success of our efforts towards any strongly desired end. They are in no sense conative forces, as are the primary emotions. They are not, like these, causes or agents in mental process; they are rather effects, joint effects of cognitive and conative operations. The so-called energy of *hope* (or of *anxiety*, or of *despair*) is the energy of the desire whose operation the emotion qualifies.

What then is the place of *belief* among these derived emotions? I submit that *belief* is essentially the same as *confidence*. The only difference is one of intellectual plane.

<sup>1</sup> For a fuller statement of the relation of these emotions I refer the reader to the third supplementary chapter of my 'Social Psychology' entitled 'The Derived Emotions.'

When the plane of activity is one of practical bodily striving, we properly speak of *confidence*, if our striving is untroubled by any anticipation of failure. When our striving proceeds in similar untroubled fashion on the purely intellectual plane, as when we reason to a conclusion untroubled by the thought that a different conclusion may be true, we properly describe our emotional state as one of *belief*.

James claimed *doubt* as an emotional state no less explicitly than *belief*; and it seems to me that in this we must follow him. But, as with *belief*, he left its place among the emotions quite undetermined. I submit that *doubt* also belongs to this group of derived emotions, and that its place may be defined by saying that it stands to *anxiety* in the same relation that obtains between *belief* and *confidence*; namely, *anxiety* and *doubt* are essentially the same emotion, but experienced on the planes of practical and purely intellectual activity respectively.

It follows that these emotional states presuppose desire or conation, that they are experienced only in the course of the operation of desire or volition. This seems to be quite obviously true, in the case of *confidence* and *anxiety*; and the facts are only a little more obscure in the case of *belief* and *doubt*. Is it not true that a proposition in which we are not interested awakens neither *belief* nor *doubt*? Tell the boor that the sum of the angles of a triangle is always equal to two right angles, and he will neither believe nor doubt. He remains neutral; because he has no desire to know. The desire to know, whether it springs simply from the instinct of curiosity, or is of more complex roots and is a desire to know for the sake of some ulterior end, is the desire in which *belief* and *doubt* are rooted. *Confidence* and *anxiety* and the other derived emotions are rooted in desires for more practical ends or objects.

That efficacy, power, or energy which Bain (and which the popular mind also) attributes to *belief* is not truly a function of that emotion. Such ascription of conative energy to *belief* is illusory. When confident of attaining our goal, we concentrate our energies along the line of action that lies

clear before us; and our activity is sustained by the pleasurable anticipation of success. In *anxiety* our energies are dissipated by conflict of inharmonious tendencies and depressed by the pain of anticipated failure. In the same way, when our aim is to know, when our goal is knowledge, and when our mental process reaches a conclusion with which no other knowledge stands in conflict or contradiction, we accept the conclusion with *belief*; further, when the time comes for action governed by such conclusion, we act with *confidence*. But, when our striving to know issues in two or more logically alternative conclusions, either one is entertained with *doubt*, and action in accordance with either is accompanied by *anxiety*.

That *belief* and *doubt* are rooted in our active and emotional nature was fully recognized by James, indeed, the realization of this truth was the source and taproot of all his pragmatist philosophy. "The quality of arousing emotion," he wrote, "of shaking, moving us or inciting us to action, has as much to do with our belief in an object's reality as the quality of giving pleasure or pain. . . . Speaking generally, the more a conceived object *excites* us [emotionally] the more reality it has." He wrote of the difficulty we find in suspending *belief* 'in the presence of an emotionally exciting idea.' "In untutored minds," he said, "this power does not exist. Every exciting thought in the natural man carries credence with it. To conceive with passion is *eo ipso* to affirm." Again he wrote: "Whichever represented objects give us sensations or incite our motor impulses, or arouse our hate, desire, or fear, are real enough for us."

All this teaching of James, showing dependence of *belief* on the active or conative tendencies of our nature, is entirely in harmony with the view I am putting forward. I am attempting merely to give to this doctrine a greater consistency and clarity, to fit the facts more systematically into the general psychological scheme. James's account suffered in two ways: (1) His tendency to sensationism in accordance with which he was logically committed to the impossible task of exhibiting *belief* as a cluster of sensations. (2) His oscillation between a mechanistic psychology (describing all

mental life in terms of mechanical brain processes, in harmony with his sensationism) and a partial and inadequate recognition of purposive striving as a fundamental category of psychology. We must remedy these two defects, (1) by rejecting the sensationist principle, (2) by recognizing that purposive striving is the foundation of all mental life, present in all mental process. We may, then, improve and simplify James's formula by saying, "Objects that evoke in us conative energy, excite us to striving, to effort, to desire or aversion, are in so far real or accepted as real."

We thus put aside as erroneous that part of James's statement in which he says objects that excite sensation in us are believed as real. This is obviously untrue—multitudes of objects excite sensation and we remain neutral, indifferent, neither affirming nor denying them. The objects we perceive and are interested in are so perceived just because they are of a nature to appeal to, to evoke some conative tendency, some impulse to action, some desire or aversion. Primitively every such object is accepted as real. But, on the plane of perceptual activity, we do not properly say that our acceptance of the object as real involves *belief* in its reality on our part; rather we must say that we react upon it, or act in regard to it, with *confidence*. This is the *primitive confidence* of instinctive behaviour. At the level of mental activity at which instinctive impulse becomes desire or aversion, through more or less clear prevision of the natural end, desire is accompanied by *confidence* in so far as the means to the desired end are clear before the mind and desire works smoothly towards its end.

When action reaches the plane upon which we work towards our desired ends, not by aid of some merely perceived means, or means suggested to the imagination by a simple process of memory or recollection, but when we work rather by means chosen by reason, by inference, or by constructive imagination working upon the testimony of other minds, then we properly speak of *belief*, of believing the means to be the true, right, or most advantageous means for the attainment of the end we desire and strive for.

*Belief* that is to say is instrumental, it is the emotion which qualifies our acceptance of particular means towards a desired end; it is the emotion of *confidence* which qualifies the working of conation on the higher plane of imaginative choice of means to a desired end. We believe in the rightness of the plan or means which our intellectual operations have helped us to choose, or we doubt the adequacy of those means; just as, on the lower plane, we act with *confidence* or with *anxiety*. When I say *desire* in this connexion, I use it in the broad sense to cover *aversion* as well as desire proper. This requires a few words. It is generally recognized that desire plays a great part in determining our beliefs; this recognition is embodied in the popular saying—"the wish is father to the thought." And psychologists have dilated at length upon the degree to which, and the many subtle ways in which, our judgment is influenced by desire, especially by the desire that springs from our strong sentiments of love. It is not so generally recognized that aversion also plays a similar part in determining *belief*; but such seems to be the fact. Consider fear, the main root of most of our strong aversions. We hear a sudden noise in the stillness and solitude of night; it excites fear, and at once our imagination depicts some cause or source of the noise of a threatening or terrible aspect, a robber, or wild beast, or what not; and, just because we fear, we for the moment believe in the reality of the object we conceive. Such is the ground of superstitious beliefs, from the grave-yard ghost to hell-fire; the believers in these things believe them to be real, not because they desire them, but because they fear them and are averse from them. And it is notorious that the sentiment of hate, whose tendencies are aversions, rather than desires, can bias our judgment as strongly as love itself.

Let us turn back now to sensation as a ground of belief to which James attached so much importance. His formula runs—whatever objects give us sensations, or incite our motor impulses, or arouse our emotions, are objects of belief for us.

I propose to amend the formula by leaving out the first category—objects that give us sensations. James himself

has cited types of experience which form the *experimentum crucis* in this matter, namely, certain pathological cases of the class of psychasthenia and *dementia praecox*. In these a permanent symptom is apt to be a lack of *belief* in the world of sense-perception; the patient sees, touches and hears things, he perceives his own body; but, although the physical things give him sensations (according to James's formula) they are not accepted as real; the whole physical world, including his body, seems to him unreal. Well, the ground of this is no lack of sensation, but the fact that the vital conative energies of such patients are either defective, insufficient, or are consumed by internal conflict, absorbed and used up in emotional experiences which are lived through in a purely imaginary world. That is to say, the physical world ceases to be real, to be believed in (although it continues to give sensations), when, by reason of our morbid condition, it no longer evokes our conative energies, our desires, and aversions, but leaves us emotionally indifferent and conatively unmoved.

*Belief* in the fullest sense is always preceded by *doubt*, deliberation, and choice of means. Such hesitation, such *doubt* brings out by contrast the full flavour of the emotion of *belief*, if and when the *doubt* is resolved, especially if suddenly resolved.

The relations of *confidence*, *anxiety*, *doubt* and *belief* may then be stated more fully as follows: We desire a certain end and strive towards it with *confidence*; difficulties arise, the painful imagination of failure partially checks our striving, and converts *confidence* to *anxiety*. Then we begin to examine our plan of action, our means chosen for the attainment of our desired end. This brings our activity from the practical to the ideal plane, the plane of thinking out our plan; and we doubt the rightness, the adequacy, of the means we contemplate. We come to a decision in favor of one plan rather than another. This decision, this choice determined in part by reason, resolves our *doubt*, makes it give place to *belief*—we believe the one means to be the best, right, adequate or true means for the attainment of our



desired end; or at least we believe the plan chosen to be the best possible, and we proceed to action in accordance with this belief. Or, if there is no immediate call for or scope for action, we rest in our *belief*, until such call for or opportunity for action arises; and then we reveal the reality of our *belief* by acting in accordance with the plan our judgment has affirmed to be the best.

On the higher intellectual plane of mental life, our plans of action are the hypotheses we choose as guides to action. A *belief* is thus an hypothesis which we hold as a guide in the line of action towards the achievement of the ends we desire and will.

Such is the nature of all scientific beliefs. The physicist's description of the physical world in which he believes is just a system of more or less consistent hypotheses; and these are so many plans by which he guides his actions, when he proceeds to further experiment.

Such also is the nature of moral belief. I believe that honesty, generosity, or justice is right. That is, I believe that the general plan of action denoted by the words, honesty, generosity, or justice, is the best plan for the attainment of the moral ends I desire. The meaning of each of these words is a plan or a scheme of action towards such ends. And if, in any particular case, I doubt whether generosity is right, it is because some other means, some other plan of action seems as likely, or more likely, to achieve the particular moral end desired, say the reform of some criminal.

*Faith* is *belief* distinguished by the peculiar conditions that establish and maintain it. Namely, when two alternative lines of action seem equally well adapted to lead us to the desired end, two hypotheses seem equally probable, and when we feel that we must work towards our end by one or other; then, by an act of volition, we choose the one, affirm it as the better, just because we cannot act and work towards our end effectively, without such definite adoption of some one plan. It is the product of the *will to believe*. And, like *belief* and the other derived emotions, it is not itself an energy; but the energy which works in us is the energy of

our desire, augmented by explicit volition and unhampered by any conflicting tendency, any tendency to follow any rival plan of action towards our desired end. The view of the psychological status of *belief* which I have briefly sketched conforms with a thoroughly pragmatic view of belief and truth. For we accept as true those plans, those hypotheses, which we believe to be the best means towards our desired end, and which justify themselves in the course of action by leading us nearer to that end, when we follow their guidance.

## HOW DO WE ACQUIRE OUR BASIC REACTIONS?

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That we have basic types of psychological behavior is not at all open to question. Every human being has a large series of deep-rooted modes of adapting himself to his surrounding stimuli, whether physical or social. Entirely clear it also appears that these fundamental types of behavior give definite character to the person who can only respond in the particular way made necessary by the possession of specific sorts of reaction systems. Furthermore, it appears that some of these basic forms of responses compose in characteristic fashion the raw materials from which are developed more complex and latterly acquired behavior of all sorts. Now because these latterly acquired and more complicated responses comprise forms of behavior which we must also term deep-seated and characteristic reactions, it is necessary to differentiate between (1) such basic forms of actions as infant behavior (*e.g.*, vocalization, whether considered as random acts or instincts) which soon become integrated into more complex responses (in this case, language), and (2) the more or less permanent or slowly changing fundamental acts as the talents, knacks or intelligences possessed by the mature person. From our observation of the functioning of the first, or what we have called the raw material type of basic responses, we can readily determine that the development of the person from a psychological standpoint consists of an integration and elaboration of previously acquired reaction systems.

Unfortunately, however, this view of the development of psychological phenomena does not meet with general acceptance, a circumstance which is owing to various conditions. Prominent among these conditions is the fact that since the development of any psychological organism may be traced back to a genuine beginning, namely, the moment of birth or

perhaps earlier, we come to a point at which our behavior apparently has no antecedents, although the scientist cannot allow any break in the continuity of his data. Hence, the tradition has sprung up that the psychological organism possesses a series of powers, potencies or potentialities, called instincts, tendencies, or impulses, which manifest themselves in responses or at least are in some way involved in complex social conduct. As an accident of our cultural development it has happened that psychologists have thrown this problem of the basic character of some types of human behavior into the psychobehavioristic mold, and so our complex responses become thought of as the neuromuscular phases of mental tendencies.

Also, it appears to us that psychologists believe in "tendencies" of all sorts because they do not add to their observations of such of our intrinsic reactions as capabilities and talents any inquiry as to how we come to have them. Another ground for the belief in potencies is the fact that psychologists start with definite facts, namely animal instinct behavior, and make the unfortunate jump from the concrete responses with which animals adapt themselves to their comparatively simple surroundings, to 'tendencies' of the human being to perform all sorts of complex social behavior.

But such a solution of the problem of our basic behavior occasions enormous difficulties, fatal indeed to the very existence of psychology as a science. How can we admit any intangible forces and powers as explanations or as antecedents of even the most essential and earliest of our reactions? Besides giving up the most fundamental principle of science, namely to deal only with observable phenomena, such a procedure we believe makes use of words which serve to conceal the necessity and to reduce our ability to cope with the difficulties attaching to the interpretation of our intrinsic reactions.

In a recent article<sup>1</sup> the writer has endeavored to suggest some of the meshes into which we become entangled when we seek to explain human behavior in terms of innate capacities, powers, or potentialities, and further, to intimate that

<sup>1</sup> A Functional Interpretation of Human Instincts, *PSYCHOL. REV.*, 1920, 27, p. 1.

another interpretation of our reactions is possible.<sup>1</sup> To a psychologist who refuses to step beyond the limits of response and stimulus it is axiomatic that all of our reactions, no matter how basic or widespread, must have a history in the actual behavior life of the person. No capacity or potentiality can be anything but an acquired reaction system which is put into operation by the stimulus through contact with which it was originally acquired. Such is the situation that exists, we submit, in all cases of our complex capacities, whether it be to think, to speak, to read, or to repair a chronometer. In the present paper the writer offers some positive suggestions concerning some of the mechanisms and conditions involved in the acquisition and operation of some forms of our constitutional psychological activity.

*The Integrative Character of Psychological Reactions and Innate Responses.*—The sole factual basis for the idea that much of our human and social behavior is innate lies in the integrative character itself, of our reactions. A positive fact it is, that in the development of the individual all of his behavior at any period of time must be the integration of previous actions. The point here is that no reaction system can be acquired *de novo*, that is to say, without having had some reactional basis with which to start. In plainer words, each stage of our development represents the acquisition of response systems, by means of the modification of previously acquired reaction systems and through the instrumentality of newer forms of stimulation, that is to say, through contact with new types of objects and conditions. Thus, the walking reactions of an infant can be observed to develop from simpler responses. Very soon after acquiring the primary

<sup>1</sup> In the article referred to the writer has used the term instinctive behavior as the name for our early acquired responses. The motive for so doing lay in the implication which the term afforded concerning the behavior basis of our early acquired reactions. But upon further reflection the term instinctive behavior appears too much like the term instinct, which meets with two types of insurmountable objection when used in connection with human behavior. Either one may assume that under the cover of the name instinctive behavior are slipped in some of the obnoxious potencies, or else one may jump to the conclusion that it refers to the comparatively simple chains of reflexes which are permanently present only in the infrahuman animals but not in the human organism.

walking reaction the infant builds up more complex locomotor responses, such as running to the call of the parents, or playmates, or fetching things when asked to bring them. Similarly the elementary sound reactions through contact with persons, become integrated into language behavior, and since the stimulating persons always belong to a particular group, the language products comprise a specific national tongue. Could we but analyze and study all or most of the stimuli factors conditioning the development of our reaction systems, and their operation when developed, we could gain a profound insight into our responses and the stimuli thereto, without invoking in any sense mystical powers and potencies.

While there is, then, a core or basis of previously possessed reaction systems in any new acquisition of behavior, we must not overlook the definite progressively adaptive character of our reactions. Our responses, with the exception of unconditioned reflexes, are developed to meet the needs of some present stimulation, and the conditioning factors of both the acquisition process and the operation of the responses themselves when acquired, are to be found in the specific surrounding conditions of the person. The human organism does not ever have in itself full blown powers or actions to make complex adjustments to intricate surroundings. All complex responses are the operation of reaction systems gradually evolved through the integration of simpler reactions. In the final analysis, or in other words at the period of birth, this core of previous activity goes back not to definite behavior segments but rather to random movements of a mobile biological being and to loosely organized and comparatively simple reflexes which we may call instinct acts.<sup>1</sup> The first forms of psychological behavior are very simple acts organized very gradually in the prenatal growth of the organism; these constitute the sole innate reactions of the organism and according to our way of thinking furnish a hypothetically

<sup>1</sup> We believe that the terms 'reflex action' and 'instinct action' should be used to differentiate between different kinds of responses, but for our present purpose, namely, the emphasis of the concrete reactional basis of all our behavior, we ignore the distinction.

inadequate basis for the belief in innate capacities and other fundamental types of reactions.

*The Subtlety and Rapidity of the Process of Acquiring Reaction Systems.*—Probably one of the important causes of overlooking the actual process of acquiring reaction systems is the subtlety and rapidity with which the process takes place. The fact is that the infant is constantly developing thousands upon thousands of reaction systems unobserved and uninfluenced by the parents. That this developmental process occurs unobserved is to a great extent owing to the parents being taken off their guard because of the difficulty they experience in deliberately training a child to do various things. It is of cardinal importance to notice that there are distinct differences between the deliberate training imposed upon an infant and the casual training resulting from a favorable contact with surrounding objects. The difficulties which baulk parents in the deliberate training of infants are due to obvious defects in the methods employed. All too frequently the parents cannot gauge correctly the proper time to stimulate the child to develop particular modes of behavior, or again, the parents use methods which they themselves would adopt were they learning the activity involved. Anyone carefully studying an infant as he responds in his own way to the countless objects and conditions around him must be impressed at once with the facility and the constancy with which modes of behavior are normally developed. Uninterruptedly the child takes on acts and attitudes which involve postures, facial expressions, modes of manipulating the mouth, and vocal apparatus, and numerous other reaction systems. To study a child carefully in its early contacts with its surroundings, to see him establish his likes, dislikes, and other traits of character, to watch him develop avoidance and pursuance responses means to give up permanently any theory of implanted powers. Later in his development the child takes on without any instruction the social, religious, economic, and other action characteristics of the family.

Strangely enough the tradition of implanted characteristics has prevailed in the face of an almost universal belief,



correctly based in fact, that the early years of childhood are the formative years of human life. Although it is universally appreciated that the child in the early years of life acquires all sorts of behavior, it is not however sufficiently recognized how deep and fundamental in the total life of the individual this formative process actually is. The fact is that through the child's early contacts with objects and persons he not only develops the ordinary adjustmental activities and social ideas, prejudices and faiths, but also the talents or interests which constitute the permanent factors of his personality traits. It should not be at all difficult to understand how a child develops talents and fundamental interests and capacities if we only remember that such interests, talents and capacities are intensively integrated reaction systems, which are put into operation by complex stimuli situations. That an interest or a talent seems to be rather a potentiality in the person instead of some definite activity need not interfere at all with our view, since we may well agree that there is no difference in principle between a talent and our capacity to solve a problem in calculus or chess. While it is entirely true, when we say that in learning the multiplication table we acquire a *capacity* to multiply, what we actually are doing is building up reactions of responding with particular verbal or graphic acts upon receiving definite stimuli.

No less subtle and rapid on the whole is the acquisition of reaction systems by the adult person. This is observable every day when we change our positions, move to another part of the country or otherwise place ourselves under the influence of new persons, new objects and conditions. Of course, whatever changes occur in the person because of the acquisition of new reaction systems can be better observed by another individual than by the person himself. As among the most striking of such new acquisitions by the person, we might mention mannerisms and other types of socially unapproved behavior called affectation.

*The Rôle of Stimuli in the Acquisition of Reactions.*—As we have already indicated, the kinds and number of reaction systems which a person develops depend upon the contacts

that person has with the surrounding objects and conditions; in plainer words, upon the opportunities to develop response systems. It follows that the same thing is true of the rapidity with which reaction systems are acquired. Each quality of an object, its color, shape and material, represents a possibility for the development by the person of specific reactions. The same thing is true of the various combinations of settings or backgrounds in which the objects are placed. To observe the elaborate education which an infant receives from contact with the popular contrivance known as the "Kiddie Kar" leaves one in no doubt concerning the effectiveness of objects to induce the acquisition of reaction systems.

Obviously the varieties of reactions which other persons induce in the individual are indefinitely more numerous than those induced by physical objects, although the latter are responsible for the acquisition by the person of many different kinds of reactions. That the contacts with persons result in the acquisition of a larger variety and more complex response systems is owing to the constant interstimulation between persons.

What the person does in play and work depends very directly upon all of his physical and personal stimulation. How a child plays and what are the games, are conditions which vary directly with the opportunities for such action. A person who has had no contact with certain kinds of animals will never fear or like them. We must of course take account here of the similarities between animals, for if a dog has bitten a child no doubt he would fear a wolf if one should appear before him. In the same way the similarity of the settings of two objects will generally cause us to carry our response over from one to the other. How we are influenced by our surroundings is excellently illustrated by the consideration of customs and language. Similarly, whether or not a person builds up bashfulness reactions or coöperative behavior depends entirely, we believe, upon his immediate circumstances.

Because of this great influence of surrounding stimuli it has become widely though superficially recognized that a

developing child should have a satisfactory home environment. If parents habitually fume and rage at each other, the child will become irritable, and sullen, and rough in manner, while when the parents are overly gentle and too yielding the child will also become so. It is because of this peculiar influence of the stimuli upon persons that the belief has prevailed in the inheritance of 'disposition.' For instance, because a child reacts like one of the parents, for example quick temperedly and impulsively, it is popularly thought that the child directly inherited such a disposition from that parent. As a matter of fact, had circumstances and conditions been different, the child might have been influenced more by the other parent and displayed entirely different 'tendencies.' To be more explicit, it is the particular parent having the closest rapport with the child who influences the latter's action to such a degree that the child resembles that parent in all he does and says. In the adult it is the particular social and economic conditions which stimulate the person to build specific reactions, and in most instances the adult stimuli counteract those of infancy and youth and thus modify the previously acquired reaction systems.

Throughout all this discussion of the influence which stimuli have upon the development of reaction systems we must bear in mind that every human individual is in contact with many objects and many persons, also that objects and persons appear in various settings and therefore many interferences in influence are inevitable. Thus for example, it is not at all determined that a child should take on the reaction systems which the home stimuli promote. We must take into account the great influence of playmates and other people. In fact, the child who at home builds up reactions of respect for property and those who own it, may as a consequence be more influenced by the customs and traditions of the neighbors who are in greater possession of property than his own parents.

*Classes of Conditioning Stimuli.*—Since stimuli and responses are reciprocal phases of behavior segments, and

since our behavior segments can be arranged in fairly distinct types, we may therefore distinguish between the various kinds of stimuli which condition the acquisition of response systems. Thus, we may classify stimuli as (1) physical; *i.e.*, those objects and conditions that induce reactions, but which are practically fixed and admit of relatively no interplay of stimulation because they are not affected by the person. We might assert that, in general, contact with physical stimuli result in the acquisition of all those response systems which serve to adjust the person to the innumerable physical conditions of our surroundings, as the avoidance of noxious objects, the seeking out of favorable or desirable things, and the modification of our relations to atmospheric conditions and changes. (2) Personal stimuli; persons and their actions, then, would constitute an entirely different class of stimuli. In this case, the stimulus itself being a person, in turn is stimulated by the reacting person and as a result there is an intricate interplay of effects of the stimulating and responding individuals. Through such mutual stimulation we develop the most complex and numerous behavior segments, and acquire such conduct as is popularly called fear, anger, rivalry, hate, love, desire, ambition, scorn, coöperation, admiration, gratitude, belief, credulity, envy, jealousy, etc. (3) Cultural; under this heading we place social situations, as famines, the volcanic devastations of cities, etc., and social objects or institutions. An institution we take to be any thing or condition which operates as a common stimulus to a definite group or series of individuals. Cultural stimuli may be of two types, those comprising the common reactions of members of a group, such as the institutions we call manners and customs, or they may be the products themselves of social behavior, as buildings, roads, distinct wearing apparel, etc. Through the operation of the cultural stimuli which obviously must coincide with personal stimulation<sup>1</sup> we build up all of the myriads of

<sup>1</sup> In our personal contacts we acquire what we may call individual human conduct as compared with the common reactions of convention. While we cannot draw sharp lines here we can differentiate between the aspects of our intellectual, æsthetic, moral, political, and other reactions, constituting the panoply of our personal behavior and those phases of our social conduct which we share with some or all of the other members of our particular group.

behavior types which are frequently denominated social conduct.

Enumerated among the reactions of social conduct are the political, social, æsthetic, moral, religious, and intellectual reactions which are hypostatized as sentiments, emotions and other states of consciousness. Let us be entirely clear concerning our views at this point. It is our theory that through contact with persons and institutions we acquire a very large series of behavior segments which make the reaction conditions of our everyday conduct. These social reactions are the integration products of the interplay of men and institutions and let us not for a moment overlook the fact that we are talking about actual acts, ways of eating, walking, talking, playing, etc. How many such social responses there are can never be made the subject of statistics. There are as many reactions as there are permutations of individuals, groups, and institutions in social situations. To attempt to make lists of the various social responses would mean to attempt to staticize and limit what from the nature of the case cannot be so handled. And let us not slight the fact that each name for social behavior, such as awe or shame, must, if it is to mean anything at all, stand for some concrete and specific action which of necessity is absolutely different for each person, and also varied within the different periods of an individual's life. An act of charity, mercy, faith, hope, shame, or resentment is a specific factual behavior situation and we must by no means overlook the fact that because for descriptive purposes we apply a conventional term to such reactions there is nothing but a conventional similarity in such behavior situations. What, we might ask, is common to the honor of thieves, nations, and gentlemen? Social conduct, we repeat again, consists of behavior segments developed through contact with actual institutions or common stimuli, and the nature of the behavior is a direct derivation of the stimulating circumstances in which the person acquires it.

*How Stimuli Function in the Acquisition of Reactions.*—On the side of the stimulating circumstances, we might arbitrarily divide the conditions which induce the development

of reaction systems into two types. We do this not because there are in fact only two classes, nor because these are entirely independent modes of inducing reaction development, but rather because in such a maze of complex situations it is well if we can contrive some order no matter how provisional and inadequate. As we proceed in our discussion we shall see that the two types of mechanisms for building up response systems overlap at almost every point. Be the situation what it may, we shall attempt to classify the mechanisms of inducing reactions into two types and we shall name these types *deliberate* and *casual* respectively. By the deliberate means of inducing reactions we refer to the process in which the human individual is brought to conform to the practices and ideals of the group in which he lives by the authority of the group. On the other hand, the casual type of process is that in which the mere contact with objects and persons results in building up appropriate reaction systems. On the whole it is probably safe to say that the casual process is the most efficacious form, as the doctrine of teaching by precept would imply, and perhaps we might also add that the reaction systems built up by this process are the more fundamental factors in the make-up of the personality.<sup>1</sup>

A. *The Casual Stimulation Processes.*—Among the earliest of the mechanisms for building up reaction systems is the stimulation of the mother or nurse, the home objects, and the parents or other members of the family and household. Through contact with these physical, personal, and social stimuli the individual builds up those fundamental forms of behavior which are primarily responsible for his particular traits and temperament. By coming into various types of contact with the stimuli we have mentioned, the child takes on those types of reactions which make it easier for him to adapt himself to a certain kind of environment, that is, one fairly common with his own, and in consequence induce him to build up other similar reactions. If the home is provided

<sup>1</sup> Here, it seems to us, lies the factual basis for the Freudian and other theories of the 'Unconscious,' and the scientist's belief in instinctive or intuitive knowledge; cf. Mach, 'The Science of Mechanics,' pp. 1, 26-28, 80-83.

with objects and conditions reflecting the musical, other artistic, or entirely different kind of interests of the parents, or a single parent, then the child will build up such reaction systems which will function as those we ordinarily call talent or interest. The person will then seek stimuli of a musical or other definite sort. Just how deep and lasting these talents and interests become depends to a great extent upon the concord and unity of the home condition, in addition to how well the child fits into the home situation. It can be readily seen that the development of certain traits in the child depends directly upon the sympathetic interest of one or both parents, an interest which itself depends upon the harmony of the home conditions.

Another very striking source of casual stimulation is the contact with persons outside the home. Just how effective and effortless the casual stimulation process may be as compared with the deliberate process is readily appreciated by everybody who has acquired some art, both with and without the intentional stimulation of insistent parents. That one is in contact with various associations of persons does not mean always that the person will build up reactions of conformity, nor that the conformity which does occur will be complete. Patently, the person just as definitely, although just as unwittingly, is induced to do entirely the opposite or to accept the stimuli only in part. Just why this situation should exist is clear when we consider that the person receives stimuli from numerous individuals—individuals belonging to different and sometimes opposing groups.

The strength of the casual stimulative process depends entirely upon the agreement or harmony of the new stimulation with the old circumstances to which the person's present reaction systems must be attributed. The lack of similarity between old and new stimulating circumstances when they are social institutions paves the way for such complex phenomena as class and race prejudices of all sorts and is moreover the basis for the psychological variations between the individuals comprising different groups. For different groups are merely aggregations of individuals who



have been stimulated by different institutions and who have in consequence developed different reactions.

Incidentally we have been led to the consideration of another powerful casual instrument for the building up of reaction systems, namely, institutions. As we have already observed, the presence of numerous institutions or common stimuli developed and fostered by the individuals of a given group force the person to acquire specific sorts of response systems with which to adapt himself to those institutions. The casual character of these acquisitions is readily understood from the fact that the institutions and the reactions to them appear to the person as natural facts with apparently no beginning or end. Anyone who attempts to change or remove one of these absolute institutions meets with the dire wrath of the individuals who have already built their adaptive behavior around such common stimuli. Only through an acquaintance with other and conflicting institutions can we be freed from the influence upon our behavior of the original stimuli found in our own family, nation or other group.

Another evidence of the power of casual stimulation is found in the fact that even in the supposedly most critical levels of activity, namely in the scientific domains, we also find it operating as effectively as in the most elementary situations; although scientific workers are presumed to be absolutely critical in their attitudes and to base their scientific information and judgment upon what they can determine to be actual occurrences, they are nevertheless greatly influenced by authorities and school affiliations. The stimulating circumstances responsible for this condition are the obvious complexities of facts which make it impossible for single individuals to be in actual contact with all phases of any phenomenon. Again, because our reaction systems are integrations of previously acquired responses, we have always a core of reactional foundation which influences the later development of reaction systems of the same general type.

Fashions in science and other domains of critical thought likewise exemplify the subtle influence of institutions in inducing the development of reaction systems. A study of

the intellectual history of nations or of general movements of thought in various centuries indicates very clearly the modifications in ideas paralleling changes of an institutional sort in the economic and social domains of activity. No field of human endeavor is uninfluenced by the changes in institutions, and especially is this fact illustrated by the periodic modification of attitudes and ideals in art.

B. *The Deliberate Process of Stimulation.*—Much of the stock of the person's reaction systems is developed by direct operation of various deliberate agencies; so that there is a constant process of modification and integration of the adjustment mechanisms of the person. Among the earliest of the intentional stimuli for building up reactions are the training efforts of the parents. The latter not only induce the acquisition of all sorts of adaptive responses to physical objects and conditions but inspire conformities to social stimuli as well. The parents knowingly or unknowingly are themselves stimulated by the needs of the social surroundings and in consequence attempt to build up in the child all sorts of behavior which will enable the latter to adapt himself to the various objects and conditions which are the inevitable environment of persons.

What the parents in the home cannot accomplish the schools are supposed to bring about. As a general proposition the schools are presumed to induce the child to acquire mainly informational responses as a preparation for work and citizenship, but as the school institutions have developed they stimulate the acquisition of all sorts of social reaction systems. Clearly, it is impossible for the functions of the parental and school training to be very sharply sundered and so they not only supplement each other, but duplicate each other's processes.

For the more mature person a large number of institutions exist for the stimulation of reactional acquisition. We need name only a few which will bring to mind the entire process of deliberate stimulation to develop all sorts of behavior systems. The military institutions actively reconstruct the individual to the extent that anyone who passes through the

course of training takes on an entirely new personality. Such a person responds differently and characteristically to all of the surrounding objects and conditions whether physical or social. Less general is the transformation of the person which the church aims to bring about, for the latter is primarily interested in the so-called moral and spiritual behavior of the person. Prominent also among the institutions which deliberately induce new and characteristic reactions in the individual are the various voluntary associations, such as fraternities, lodges, literary, social and other clubs. Each of these is designed intentionally to modify the person and his behavior in order that he will yield to definite prescriptions of social action.

*Distinction between Stimulating Situations and Biological Environment.*—The psychological problem of stimulus and response must not be confused with the biological problem of inheritance versus environment. Let it be understood therefore that one should not draw the conclusion from our argument that we are denying the potency of heredity in favor of the strength of the environment. Our argument, the reader will recall, assumes that the condition for any adjustment is the presence both of a stimulus object and of a reaction system for that stimulus which the person has acquired and added to his behavior equipment. Now one might properly conclude that our exposition does imply an exclusion of all immediate heredity factors in the integration of behavior, but at the same time it is necessary to observe that we exclude also the correlated biological environment. For notice that different individuals at the same moment or the same individual at different moments may be aroused to action by different stimuli in the same biological environment. The problem of inheritance and environment from our standpoint then must deal with a prepsychological factor that goes below the development of adjustment acts. In plainer words, we must distinguish here between (1) the psychological fact of an integration of an organized specific response with a particular excitant of that response, which involves no direct hereditary factor, and (2) the biological

fact of a correspondence between specific organic structures with their more or less general functions such as growth and reproduction, and the ecological conditions to which they are adapted, which may and frequently does involve many direct and immediate hereditary factors.

To the largest extent the inheritance-environment problem refers to the development and continuation of biological characteristics, both functional and structural, which may be only very remotely the basis for psychological phenomena. In general, the environmental conditions of the persons as such need not necessarily be stimuli to psychological action even though they may be potent conditions for the preservation or modification of the biological characteristics of the organism. All the stimuli of the person, however, must be considered as parts of the environment of the organism, although many of them have little or no effect upon the biological changes in the individual. The environment is therefore distinguished from the psychological stimuli in that the latter are essentially conditioning phases of segments of behavior. They are the arousers to activity or the modifiers of behavior in the course of adaptation. The probability exists, however, that in the course of time, by bringing about changes in the organism, the environment may condition the activities of the person. But this situation is very different from the direct relation of stimuli and responses each of which is a reciprocal phase of a behavior segment. The biological environment is from the psychological standpoint practically a static affair, while stimuli are by nature essentially active. Warmth (tropical climatic condition) as an environmental feature of the organism's life is a constant and permanent condition, while warmth (stove) as a stimulus is an immediate inducement to specific activity.

*Types of Behavior Equipment.*—Because the reaction systems acquired by the individual cover the extremely wide range from elementary maintenance responses to the most elaborate creative acts, and from the most deep seated attitudes to the most critical thought, we might profit by an attempt to inject some order into the various types of behavior

in our reaction equipment. From among the hundreds, yes, thousands of various types of behavior acquired by the person through contact with various objects and situations we may for illustrative purposes isolate the following:<sup>1</sup>

1. Adaptive Reactions.
2. Compensatory Reactions.
3. Protective Reactions.
4. Defensive Reactions.
5. Manipulative Reactions.
6. Expressive Reactions.
7. Exhibitive Reactions.
8. Approbative Reactions.
9. Recessive Reactions.
10. Accommodative Reactions.

1. *Adaptive Reactions.*—By adaptive reactions we mean to refer to the class of actions which to all appearances seem to orient the person in his surroundings, and put him in a satisfactory relationship to the objects and situations with which he comes into contact. As examples of adaptive behavior we might cite the specific reactions acquired by the infant in learning to balance himself in the upright posture or to avoid falling over objects, and the behavior of mature persons in learning to handle a new machine or to use new tools. The eating reactions of an infant are also adaptive acts, while the acquisition of social graces by more mature persons continues the process of acquiring adjustive reaction systems.

2. *Compensatory Reactions.*—Many acts there are which do not perhaps adapt the person directly to an object, but rather replace acts which would perform that office. The child who cannot ride his bicycle can compensate for the lack by pushing it. When a child cannot overcome his opponent he sticks out his tongue at him or otherwise attempts to overcome his disability. Do not the lies told by children constitute an effort to compensate for incapacities of various

<sup>1</sup> In such a study as this it is only fair to acknowledge the help which psychologists have received from the observations and descriptions of the development of behavior furnished by the psychiatrists. This acknowledgment, however, need not imply any sympathy for the theoretical formulations of the psychopathologists.

sorts?<sup>1</sup> In later stages of development an individual lacking a musical voice similar to one possessed by an admired or envied person, will compensate for this lack by acquiring acting capacities, and thus he will be able to meet what is to him a difficult situation. Many of our manners and ideals are reactions acquired as compensations for acts which we cannot, dare not, or may not do. Some complex acts which may be referred to as talent and interest, develop at first as compensations and in many cases continue to develop and become added to because they serve an increasing need to compensate for various conditions. In recent years it has become quite generally recognized that much of the play activity of infancy and childhood is developed and indulged in as compensations or substitutions for acts and objects not available. Very good examples of compensatory behavior are the activities of the person presumed to possess great competence as a scholar or business man, but who in fact is only a splendid orator, conversationalist and punster, or one who merely possesses the reactions of a 'good fellow.'

3. *Protective Reactions.*—In our various contacts with other persons we build up reaction systems to serve as protective mechanisms. In simple form these are injury-inflicting responses involving the use of the hands, the head, and the feet for striking, kicking, and otherwise resisting the attacks of others upon oneself or playthings. For more complex situations the protective responses take on more subtle forms; they may be modes of speaking, the acquisition of various sorts of information as bulwarks of protection; they comprise also various forms of agreeing with people, organizing cliques, the distribution of gifts, and a host of other kinds of action.

4. *Defensive Reactions.*—As contrasted with the protective mechanisms acquired by the individual, the defensive mechanisms are primarily modes of reducing the stimuli which we ourselves offer to the aggressive acts of others. The simplest defensive mechanisms are illustrated by hiding self and possessions, by smiling and otherwise conciliating the

<sup>1</sup> In this connection cf. Kempf, 'Psychopathology,' Chap. III.

hostile individual; so that by appearing friendly and unarmed one avoids stimulating an attack. In more complex stages we can place under this classification the actions which are attempts to explain and rationalize one's behavior in defending it from self and others. As defensive behavior we probably acquire many of our most intimate social act-traits, such as suavity, pretension, etc. Enlightening in this connection is the question as to how much of our political, religious, and economic heterodoxy is acquired as defense reaction against unbearable conditions and doctrines.

Also acquired among the defensive mechanisms are various negative reactions serving to soften or remove the evil effects of certain noxious objects or situations. Such defense actions are best illustrated by the abnormal blindness, deafness, paralysis and other negative responses met with in persons commonly referred to as hysterical. The acquisition of these negative responses occurs through contact with sights, sounds and need for movement which appear to overwhelm the persons concerned. Of course these negative responses are merely extreme exaggerations of everyday behavior of a similar sort. For instance in our everyday reactions we say we did not attend to a person who was disagreeable to us, when in reality we had to pay attention to him first before we could blind ourselves to or avoid him.

5. *Manipulative Reactions.*—A very general observation it is that an infant will persist in manipulating all objects that come readily to hand. So widespread is this manipulation activity and so early does it appear that most writers on instincts include a manipulation instinct in their lists. More critical observation, however, indicates that such behavior is to a considerable extent orientative activity, indulged in because of the challenging stimulation of objects. What else could happen besides the opening and closing of a hinged door? Significantly enough observations show that only manipulative objects are manipulated and that the type of manipulation depends upon the shape, the weight, and other qualities of objects. In no case do we observe any attempt to manipulate things which do not especially invite



such responses. Illustrative of manipulative reactions in adults are such random acts as toying with a pencil while conversing and the many false moves performed while learning to operate a new machine.

6. *Expressive Reactions.*—To all it must be self evident that the human individual is not merely an adaptive mechanism, but also possesses an equipment of reaction systems making for self development and self expression. As a consequence of the affective conditions induced in individuals by surrounding stimuli he imposes in various ways his personality upon surrounding objects and situations. When thus affected by surrounding conditions the person seeks out what from an adaptive standpoint might be called unnecessary but still congenial situations, and new experiences. Such pursuit of new experiences leads to behavior which may be called transformative and expressive. Among children we observe as examples of such behavior rhyming, and recounting of words heard, or the names of playmates. Not dissimilar are the very simplest expressive acts from the kind we have called manipulatory. In the more complex and social types of behavior, expressive acts are illustrated by individual mannerisms, by peculiarities of language, handwriting and preferences of all sorts which the individual has acquired. Further, the appreciation and creation of art objects and literature are modes of a positive, self-expressive action upon our surroundings, rather than mere adjustments to those surroundings.

7. *Exhibitive Reactions.*—Among the displaying or exhibitive reactions we place those which stimulate the interest, admiration or repugnance of the observer. As in all elementary behavior the reacting person is not intentionally soliciting admiration, but the mere presence of other people stimulates the individual to indulge in various forms of ostentatious behavior, to produce sounds, act parts, repeat one's own actions, mimic others, and exhibit prowess of all sorts, etc. In the more mature person the exhibitory behavior involves taking cognizance of the interests of the observing person and responding accordingly.

8. *Approbative Reactions.*—With the accumulating contacts of the person with surrounding objects and persons he develops preference reactions which later become integrated with verbal and knowledge responses, thus becoming interest and aptitude behavior. Quite accidental may be the primary development of the preference reaction, in case it is not due to some factor reaching back to the biological stock of the person as superior color or tone sensitivity. Should the first contact of the individual with certain colors throw him into relation with more or less brilliant hues or should the first contact with certain objects happen to favor certain of them because of their variety or intensity, then those favored objects may be ever after preferred. Again, these early preference responses may arise because of the affective conditions induced in the individual by various objects or because of their negative qualities, as the absence of thorns, or other injurious or pain-inflicting parts. No matter what the original influence of such particular integrations of reactions may be, the fact remains that when such integrations of reaction systems occur, then the person has a basis for interest or curiosity in particular objects and persons. The beginning of such a system of reactions begets a further pursuit and interest in similar objects with a consequent increase of the given type of reaction systems and still further pursuits of their exciting stimuli. The interest in certain objects and persons is proportionate to the knowledge and skill one has previously acquired in reacting to them.

Out of the simple preference reactions develop the complex admiration responses of the social and intellectual level of human intercourse. Thus the person acquires and expresses certain full fledged value judgments concerning books, works of art, and persons found in his surroundings. Complex as this type of behavior appears, it is still possible to trace the development of the complex admiration reactions from the simpler preference responses.

9. *Recessive Reactions.*—Just as certain types of cumulative responses condition the further pursuit of objects and persons, so the first contacts of an individual may result in a

withdrawing from and consequent lack of interest in certain stimuli. Frequently, the results are more positive and the person may shun and be very careful to avoid objects and persons, for response to whom he has no reaction systems. Lacking response systems and being unable to respond effectively, the individual may develop compensatory responses, which may amount to defamation and contempt for the other person or object.

10. *Accommodative Reactions.*—Through constant stimulation from, and reaction to other persons, individuals, from their very infancy, learn to live with others. Through actual struggles with people and through overt teaching, persons build up reactions of toleration and even actual sympathy. Of primary importance as a condition for building up sympathetic attitudes and acts are fairly common surrounding stimuli, so there can be a common personality basis for harmonious and sympathetic action. It is because of the common surroundings that among children the more usual relationship is sympathetic until they are taught either by situations as casual stimuli or by actual teaching that there are occasions for differences and conflicts.

With emphasis, we repeat that the classification of reactions that we have proposed is intended only to illustrate the fact that our complex maze of behavior may be arranged in some order. We are, therefore, far from asserting that these reactions are mutually unrelated behavior types. Rather our purpose is to apply distinguishing names to actions that are inextricably intertwined and interwoven in the total fabric of human behavior, and in fact many of which occur as factors in a single segment of behavior. Especially clear it should be made at this point that we find no basic morphological differences whatsoever between the reactions that are considered to belong to the domain of physiological psychology and those classified under the rubric of social psychology. From an adjustment standpoint our reactions are all of a piece, but of course the stimuli to, and occasions for reaction differ very markedly indeed.

*How Play Illustrates the Intermingling of Behavior Types.*—No better can the integration and intermingling of our

various types of behavior be illustrated than in a study of that practically universal form of psychological activity called play—which activity, it is safe to say, involves all of the types of behavior which we can isolate. But first we must note how crudely all sorts of activities are confounded under the name play—a term we apply to such widely divergent activities as (1) the complex of movements representing sheer biological vitality, (2) all sorts of direct intelligent and unintelligent responses to stimuli, besides (3) a host of different socially admonished and socially sanctioned responses. Let us not forget, however, that when we do attempt to analyze and determine what behavior may strictly be called play we find that it is an indefinitely complicated congeries of distinctive forms of psychological reaction.

Because play is so intricate a complex of various forms of psychological activity it is extremely difficult to describe and very troublesome to those who wish to explain it at a stroke.

Those who conceive of human behavior as autonomous mental states, as manifestations of simple states of consciousness, or as in any sense a detached reaction, must perforce find play to be a very elusive and unaccountable phenomenon. Play is not merely a preparation for life, although it is clear that no matter under what circumstances one acquires and integrates responses they may later be used; nor is play merely a means of relieving surplus energies. Again, play is not merely a compensation for action which one is unable to perform. Rather, play activity involves all of these conditions and numerous others.<sup>1</sup>

It is our deep-seated conviction that play cannot be described or explained without a close and careful consideration of the specific conditions involved. For we cannot but think that there are as many differences in play as there are in work and that the differences between the various

<sup>1</sup> Some insight is here afforded us into the difficulties of the play theories. We wish to point out in especial that only the compensation theory seems to have a solid psychological foundation in that it is based directly upon facts of stimulus and response. The others are teleological or at best physiological.

kinds of play actions are as great, if not greater than the differences between thinking and reflex action.

Much of what is true of play is also true of such activities as modesty, charity, coöperation, imitation, bashfulness, religiousness, love, jealousy, etc. Each of these terms stands not for sharply defined, isolated types of behavior, but for hosts of interrelated reaction systems built up in complex social situations. And further, each name stands for a multiplicity of classes of adaptive behavior. We cannot too strongly urge at this point nor emphasize too forcefully that what people usually call unaccountable inherited tendencies or traits are really such complex integrative organizations of reaction systems that the simple correlations of stimuli and responses are lost sight of in the presence of the total mass of behavior.

One more point. All of the acquisitions of behavior that we have been indicating are entirely independent of the wishes or knowledge of the acquiring person. Not that the person need be unaware of his developing modes of behavior, but rather such knowledge on the part of the person is not an essential feature of the acquisitional process. The importance of this point lies in its warning not to confuse the unintentional and intentional acquisition of response systems. Clearly, there are two distinct processes here, as is illustrated by the difference in the learning of language by a native of the country in which the language is spoken, or by the mature person who deliberately undertakes to acquire it. Possibly, the term habits would more suitably symbolize the type of acquisition in which the person deliberately undertakes the development of some skill or other type of reaction.

*The Integrative Basis for Dissociation.*—Excellentlly do the pathological conditions called dissociations illustrate the integrative character of our reactions, for the possibility of the various dissociations arises precisely from the fact that the reactions of the person are integrated and organized into types and groups through contact with the various surroundings. Since the individual develops his particular reaction systems by contact with stimulating situations it seems clear

enough that, since those stimulating conditions are of various sorts, he will build up systems which may be mutually inharmonious. Just how inharmonious the organizations of response systems will be must depend upon the variability in the stimulating situations. Thus the multifarious stimulating circumstances of the ordinary family would supply no striking occasion for acquiring such incompatible responses as could later result in dissociation. If, however, the family conditions are not homogeneous and orderly the personality resulting may be fertile ground for disorganization. In every case of dissociation, of course, the crisis involves the person facing an overwhelming or at least a tremendously shocking situation. What we are especially interested to point out is that the facts of multiple personality and other forms of dissociation-phenomena convincingly show us how complex reactions are integrated from simpler responses and organized personalities developed from complex systems of responses.

*The Biological Basis for the Integration and Acquisition of Reaction Systems.*—From the fact that the whole psychological personality is based upon a biological foundation, in that the person is always at the same time a biological organism, it is obvious that the kind of biological stock that is present will determine to a considerable degree the kind and organization of reaction systems in any individual case. If there is any serious injury of the organism, either during prenatal or postnatal development, then clearly the person will be unable to develop as complex or as effective a series of response systems as the uninjured person. Again, there may be varieties in biological stock which are observed in the form of more or less vitality in the person. If the number and kinds of reaction systems a person acquires depend upon the contacts with objects, then clearly the more active the person is the more contacts he will have with objects and persons. The writer hesitatingly suggests the query whether the 'vitality' of a person is not a direct function of the status of the glandular activities of the organism.

In general, two types of conditions influencing the acquisition of reactions are supplied by the biological character of the person. In the first place, as we have already suggested, the type of stock of the organism conditions very markedly and very directly the behavior development of the person, since of course all the capacities and accomplishments of the person depend upon the acquisition of reaction systems. Any defect in the biological stock, such as the degeneration of neural, muscular, or osseous tissue, means a defective development of the person. The same thing is true of any defect in the physiological systems, such as the respiratory, circulatory, secretory or other types of functions.

In the second place, the biological character of the organism may be considered not as the matrix for the development of the response systems, but rather as the setting or background of the contacts of the person with his stimuli. Since by far the largest number of human responses are adjustments to other persons, it is clear that the attractiveness or otherwise of the person, with respect to form, complexion, color of hair, and eyes, etc., may greatly influence his acquiring more and different types of responses. An extreme illustration of what is meant is found in the case of the foundling who because of certain pleasing anatomical characteristics is chosen from among many others, to be given the opportunity to develop a rich and varied personality. These seemingly extraneous influences of our behavior may extend to the rather intangible phases of our conduct such as the feeling reactions which we excite in other persons.

Moreover, the presence of stimuli-opportunities for the acquisition of particular types and quantities of response systems may be furthered or hindered by the biological condition of health. One may be living in the midst of absorbing athletic activities, but if one is in poor physical condition one cannot expect to partake in such activities or become an athlete.

*Conclusion.*—In offering these various suggestions of the ways and means by which persons develop their early fundamental and basic types of behavior, we must emphatically



point out that no attempt has been made, nor could it be made, to do anything more than illustrate a principle. For the very principle which we have attempted to illustrate stands opposed to any such *a priori* procedure as the narration of how anyone has acquired response systems without having observed the process. Precisely what circumstances lead to the integration of specific reactions can only be known from a direct study of a particular individual and the surroundings in which he is found. More point there is to this suggestion when we consider that there is no determination or inevitability about our developing reaction systems. With the exception of the stimulating circumstances and the biological factors we have mentioned, the development of reactions is wholly a fortuitous process. Our position is that all psychological phenomena must be considered as involving always the two phases of stimulus and response. Under no circumstances can we admit that our reactions are the sheer unfolding of forces or processes within the person alone, uninfluenced by stimuli, which are presumed merely to set off reactions without conditioning their existence. In psychological writings this latter view is very prevalent irrespective of the fact whether the powers in the individual are conceived of as exclusively mental or physiological.

What we have attempted to do has been to point to some facts observed in a number of cases, which exemplify the law that the number and kind of reaction systems we acquire depend entirely upon the kind and frequency of stimuli with which we are in contact, plus the reaction systems previously acquired. Because we are dealing with what are essentially intricate and highly evolved adaptations to surroundings, we cannot expect to find exclusively in the person the conditions for such adaptations; rather we must seek for these conditions in the interrelationship between the persons and their surrounding stimuli. It is needless to assert, therefore, that we must not confine our study of human behavior to an exclusive analysis of its physiological phases and to the complete neglect of essential social factors.

With respect to general methods of observation psychology is exactly in the same predicament as is physics. The physicist cannot attribute the fact that water boils at a certain pressure and temperature to a power in the water; instead he has the task of accurately determining and recording the incidence of boiling, with pressure, temperature, and other observable conditions. Likewise, the psychologist must refrain from doing anything other than describe the contacts of psychological organisms with stimuli and their settings, during the variations of the organism's well-being, and finally the observer must also take account of how the organism has been affected by immediately preceding reactions. To the writer it seems that the study of psychological phenomena exclusively in terms of responses to stimuli, as we have suggested, makes possible valuable non-prejudiced descriptions of facts, in spite of the extreme difficulty of the data with which the psychologist must work.

## FACT AND INFERENCE IN RAYMOND WHEELER'S DOCTRINE OF WILL AND SELF-ACTIVITY

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### I.

Professor Raymond Wheeler has recently published a report of the 'experimental investigation of the process of choosing' which he carried on during 1913-1915 with highly trained observers in the Clark University laboratory. The method was adapted from that of Michotte and Prüm, but was very effectively modified. Two pictures, or else the titles of two familiar Victrola selections, were presented at each experimental sitting with the direction, "Select one (of the pictures) to hang in your room or choose which of these selections I shall play to you."<sup>1</sup> Each observer dictated his introspection immediately after making his choice either to the experimenter or to a stenographer. Very full excerpts from these introspections, of which there were more than a thousand, are reproduced.

The positive outcome of the study is the experimental demonstration that every phase of the experience of choosing, while varying very much in verbal and concrete imagery from observer to observer, invariably includes kinaesthetic sensations<sup>2</sup> even in face of the occasional instruction to choose without employing any kinaesthetic process<sup>3</sup> and even in the choice between such unsensational alternatives as moral principles.<sup>4</sup> Professor Wheeler bases on this result a theory of will which involves two related and, in the view of the present writer, highly questionable inferences: (1), first and positively, that volition consists entirely in kinaesthetic

<sup>1</sup> For the full text of the directions, cf. Raymond H. Wheeler, 'An Experimental Investigation of the Process of Choosing,' University of Oregon Publications, 1920, 1, No. 2, 4. All the undesignated references of this paper are to this monograph.

<sup>2</sup> *Op. cit.*, pp. 8, 49 *seq. et passim*.

<sup>3</sup> *Op. cit.*, pp. 40 ff.

<sup>4</sup> *Op. cit.*, pp. 44 f.

sensations;<sup>1</sup> that consequently (2) volition is not rightly described as self-activity.

It is clear, at the outset, that the conclusion, 'choice consists in kinaesthetic and organic sensation' does not follow inevitably from the discovery that choice always contains kinaesthetic consciousness. For to say that *x* always *involves* or *contains* *y* is certainly different from saying that *x* *consists in*, or is *constituted by*, *y*. Thus, cake always contains flour but does not consist in flour; water always contains oxygen but does not consist in oxygen; and (to make use of a closer analogy) a poem contains letters but does not consist in letters. Similarly volition, though certainly containing kinaesthetic consciousness, need not, for that reason, consist in the awareness of throat or neck or diaphragm sensations. Thus, the persistence of kinaesthetic consciousness in the widely varying choices of Wheeler's subjects at best proves merely that kinaesthetic sensations of some sort are invariably present in volition and falls far short of demonstrating that volition is no more than kinaesthetic consciousness.

Wheeler, however, supports his identification of will with kinaesthetic sensation by another important consideration, the failure of his subjects in their introspection to report the occurrence either of a consciousness of self or of the experience of mental activity. The discussion of this second and negative part of Wheeler's theory of will constitutes the main topic of this paper. All his observers, Dr. Wheeler says: "agreed that, in their most genuine and difficult acts of choosing, such experiences as might be termed 'feelings of mental activity,' 'immediate consciousness of the self,' 'elemental awareness of the self,' 'consciousness of willing,' etc., could be analyzed into organic and kinaesthetic processes, with occasional visual, auditory, or verbal accompaniments." And this negative testimony merits acceptance, Wheeler argues, since his observers were "familiar with the conception of will as involving mental activity or self"; and since their introspections were more "detailed and carefully given" than any which Professor Wheeler (and for that

<sup>1</sup> *Op. cit.*, *passim*. Cf. Wheeler, R. H., 'Theories of the Will and Kinaesthetic Sensations,' *PSYCHOL. REV.*, 1920, 27, p. 359.

matter, the writer of this review) has elsewhere found. Hence, Dr. Wheeler concludes: "In a voluntary choice there is no consciousness of activity as such, no awareness of an immediate and unanalyzable 'self' (p. 51<sup>4</sup>)."

This result, however, as Wheeler does not fail to note, is precisely opposed to that of other investigations, both experimental and purely introspective, in particular to those of Michotte and Prüm, Ach, Barrett, Meumann and Calkins. These students of volition agree with Wheeler in that they find kinaesthetic and organic sensations in volition. They differ from him however in that they find in addition (1) a "consciousness of activity . . . absolutely different from the feeling of muscular activity" and, (2) involved in this consciousness of activity, an awareness of the self which is active, the consciousness that "it was I who acted."<sup>1</sup>

This blank opposition of careful investigators seems to augur ill, it may be noted, for the future of the very method of introspection which Wheeler employs. For who is to decide whether Michotte and Ach, biased by one set of preconceptions, have inadequately analyzed the awareness of self-activity, or whether Wheeler, biased in another direction, has failed to recognize his kinaesthetic sensations as themselves constituents of a consciousness of active self? He is, of course, "firmly convinced that the 'feeling of mental activity'" described by Ach and by Michotte is a "complex of kinaesthetic sensations" in spite of their explicit denial of this identification. And he elsewhere suggests the possibility "that Meumann's consciousness of the self in the acceptance of a task" is an interpretation "unwittingly based upon an immediately experienced but complex and diffuse kinaesthetic background and nothing else."<sup>2</sup> But, once more, who can be sure that it is not Wheeler rather than Michotte or Ach who is unwittingly misinterpreting the facts of experience? In this perplexity one must, of course, turn from the state-

<sup>1</sup> Michotte et Prüm, *op. cit.*, pp. 194, 189. Cf. N. Ach, 'Ueber den Willensakt und das Temperament,' pp. 240 *et al.*, on the *Betätigung* in which will consists, as distinguished from the perceptual phase (*das anschauliche Moment*, p. 238) of will. In this activity, Ach holds, the *Ichseite* is prominent.

<sup>2</sup> Wheeler, R. H., 'Theories of the Will,' *loc. cit.*, p. 358<sup>3</sup>.

ments of conclusions to the records of the facts on which the conclusions are based, in this case, to the reported introspections of observers. The following pages bring together at least one representative quotation from each of the observers whom Wheeler quotes and the comment of Wheeler on the position of each of these observers as regards the consciousness of self-activity in volition. Special effort has been made to select full and representative accounts of the sensational experiences reported.

## II.

### INTROSPECTIONS OF WHEELER'S OBSERVERS

#### *Observer A<sup>1</sup>*

(a) *Introspection of A* (pp. 5 f.):<sup>2</sup> "When the experimenter announced that he was going to give me primitive music, I had the vocal-motor-auditory: 'Oh! Primitive music; (I) <sup>3</sup> like primitive music; choose (the) one (I) prefer; (the) don't want either (alternative) won't happen.' This was followed by the vocal-motor-auditory: 'Probably don't know either; good, (I am) interested in primitive music; hurry up and present them to me.'"

(b) *Wheeler's estimate of A's introspections* (p. 31<sup>3</sup>): "Neither *D* nor *A* are conscious of the self or of a feeling of activity during the act of choosing. . . . Both stated, upon questioning, that they were conscious of themselves or of mental activity after the final decision had taken place and relaxation had occurred, but agreed that this awareness was merely retrospective and interpretative, . . . suggested by [the experimenter's] questions and . . . not characteristic of their acts of choosing."

#### *Observer B*

(c) *Introspection of B* (pp. 9<sup>4</sup> f.): . . . "Then there was a brief period of suspense characterized by muscular strains about the shoulders, brows, mouth, and eyes and by a vocal-motor self-

<sup>1</sup> "The observers," Professor Wheeler says (p. 4), "who took part in this investigation were all trained introspectors. . . . They included Professor John W. Baird, Assistant Professor Samuel W. Fernberger, Drs. S. C. Fisher, Ivy G. Campbell, Florence Mateer, George S. Snoddy, Harold R. Crosland, F. J. O'Brien, and the writer." Wheeler quotes from the reports of six of these nine observers—he does not tell us from which six.

<sup>2</sup> For similar introspections of *A*, cf. pp. 12<sup>2</sup>, 41<sup>2</sup>.

<sup>3</sup> Parentheses denote the observer's 'own interpretation of his experiences.'

questioning: 'What am I to do? What do I know about the Rondo selection?' Then I had a vague and fleeting visual consciousness. . . . I then had the vocal-motor-auditory: 'I always prefer a vocal selection.'"

(d) *Wheeler's estimate of B* (p. 30): "*B* was never conscious in elemental fashion either of the self or of a feeling of activity. He found that the rapidity with which his attention shifted from one process to another, together with a background of kinaesthetic and organic processes, referred to circulation and respiration, were the basis of any tendency to interpret his experiences as feeling of activity."

#### Observer C

(e) *Introspection of C* (p. 11<sup>2</sup>): "I then perceived the name 'Caruso' and . . . had auditory imagery of Caruso's voice. . . . These processes were accompanied by a mass of organic and kinaesthetic contents, of muscular tensions, sensations from respiratory and apparently circulatory changes, all of which meant to me a feeling of excitement; I tended to straighten up in my chair; . . . the kinaesthetic and organic processes increased in their intensity and scope and were accompanied by marked pleasant affective toning [These experiences were interpreted by the reagent as a tendency to choose the 'Rusticana' title].<sup>1</sup> My glance then fell again upon the 'Mad Scene' title and the visual and auditory imagery which I had had before now reappeared, together with a similar organic and kinaesthetic complex . . . (All this meant to me that I was equally fond of both selections). Then I was aware of the vocal-motor-auditory: 'Which one of these shall I hear?'"

(f) *Wheeler's estimate of C* (pp. 29<sup>4</sup> f.): "*C* was frequently aware of himself in the act of choosing . . . but as with *J* it was always present to consciousness, not in elemental terms, but in terms of kinaesthetic sensations and images. . . . This consciousness together with an awareness of organic . . . processes gave to the reagent's consciousness complex states which he interpreted as 'feelings of activity, exhilaration, excitement' and the like. But here as before 'feelings of activity' or any 'awareness of the self' as such were not immediate experiences but interpretative and retrospective experiences, entirely."

#### Observer D

(g) *D's introspection* (p. 17<sup>2</sup>): "I first perceived the 'Evening Star' title and . . . repeated each word in auditory imagery.

<sup>1</sup> The brackets enclose comment made by Wheeler.



This was accompanied by a rapid onset of pleasantness together with a feeling of familiarity. . . . I then read the other title and very much the same series of experiences developed; then followed the vocal-motor: 'Well, both are good; both poetic; which do I want? This is going to be a difficult choice. . . .' For a short time I was aware of strains about the jaws, eyes, and in the throat; then followed the verbal process: 'Now let me see the first title again.' I turned to the upper card; I read it over carefully and came to the name, Wagner . . . ; then I was aware of a kinaesthetic 'jerk' . . . ; I noted kinaesthetic tensions and incipient movements of leaning forward, slightly; . . . at this juncture appeared the verbal process: 'Well, I know this is good; better take the one you are certain of'; this was accompanied by marked pleasantness. I then turned to the experimenter and said 'I will take this one.'"

(h) For Wheeler's estimate, see his estimate of *A*.

#### Observer *E*

(j) *Introspection of E* (pp. 15<sup>2</sup> f.): "I first perceived the 'Barcarolle' title. . . . I had 'tingling' sensations which seemed to be distributed over my entire body and . . . visual imagery of a red phonograph record and . . . of myself seated before the phonograph. . . . The feeling tone, the kinaesthetic and tactual sensations of bodily 'tingling' increased and I found myself saying in verbal imagery: 'I want to hear this one.' . . . Then I asked myself in vocal-motor-auditory imagery: 'Do I really want to hear this?' and the answer to this question was a 'welling-up' of pleasantness, of tensions in the throat, arms, chest, a sensation of warmth referred to the region of the diaphragm and faint visual imagery of the phonograph. All this meant to me an 'adjustment' to hear the selection. Then I had the verbal process 'Why do you want to hear this?' . . . I was then conscious that I seemed to be in the act of choosing the 'Barcarolle' title."

(k) *Wheeler's estimate of E* (pp. 30<sup>3</sup>, 25<sup>2</sup>): "*E* agreed with our other observers in reporting no elemental awareness of the self or of 'mental activity' in the act of choosing. . . . *E* very seldom experienced a final decision or a vigorous tendency to choose which he did not delay by the self-questioning: 'Do I really want to hear this?' 'Why do I want this alternative?' and then he would recall the nature of his previous tendencies to choose by 'living them over' in attenuated or telescoped fashion; he would compare their relative intensity and complexity, the result of which invariably

consisted of an 'onrush' of the 'flux' of kinaesthetic and organic processes which had constituted these initial tendencies, and a 'reflex' shift of attention to the experimenter, together with an announcement of the choice."

*Observer F*

(1) *Introspection of F* (p. 42): "After reading the two titles I had vocal-motor imagery: 'Which of these do I want?' For some time I found myself in a semi-relaxed condition which seemed to be a state of waiting or of expectancy for visual or motor imagery to appear."

*No estimate of F, by Wheeler*, which bears on the topic of discussion.

*Observer J*

*Introspections of J* (m, pp. 17<sup>3</sup> f.): "... While all this was happening I was also aware of a very rich and complex motor and organic reaction, consisting of sensations from circulatory changes, respiratory changes, sensations of pressure and hollowness from the region of the stomach and diaphragm, of tensions in the throat and chest. (All this meant to me that I was tending to choose the 'Rondo' selection and also indicated a great fondness for this particular selection.)"

(n, pp. 12<sup>3</sup> f. Description of the choice between Mendelssohn's "Oh for the Wings of a Dove" and Beethoven's "Moonlight Sonata"): "My bodily self, the title, the space between me and the title were for an instant thrown into a complex kinaesthetic and visual *schema*; this represented to me that I was ... in the act of 'accepting' this title as my choice. As these processes were being thrown into this schema, I was aware of a long, drawn-out, breathy, auditory: 'Oh, I want this.'" [Later on in this same introspection (p. 14), *J* became aware that he was not "consciously fulfilling the *Aufgabe*; this," he adds, "was present in terms of kinaesthetic imagery of leaning forward slightly, of drooping the shoulders, and of the vocal-motor: 'What a fool to choose anything without a reason!'" ]

*Wheeler's estimates of J* (o, p. 29<sup>3</sup>): "In the more vigorous choices *J* always found that his consciousness of the self and his awareness of 'willing' could be analyzed into complexes of experiences [kinaesthetic and organic sensations and ... pleasantness] as stated above."

(*p*, pp. 24<sup>2</sup>-25<sup>1</sup>): "When these various processes [kinaesthetic, organic, etc.] reached their maximal intensity or complexity *J* was always aware of himself in the experimental situation and he invariably interpreted this awareness as 'an attitude of acceptance' or as 'an acceptance of the alternative.' . . . He seldom imposed upon himself the subsidiary task to compare the two alternatives unless the choice was unusually long and difficult; his final decision consisted of a complex motor and organic reaction. . . ."

### III.

Unquestionably these introspections show, as Wheeler has insisted, the invariable presence of kinaesthetic and organic sensation in volitions of every type. The question is: do they also indicate the occurrence of a 'feeling of activity' and of an awareness of self? As to the first point, occasional phrases seem to suggest the presence, in addition to the kinaesthetic consciousness, of a 'feeling of activity.' So, Wheeler says of *B* that certain of his "kinaesthetic and organic processes . . . were the basis of any tendency to interpret<sup>1</sup> his experiences as feeling of activity" (p. 30) and of *C*, similarly, that he 'interpreted'<sup>1</sup> certain complex sensational states as "'feelings of activity, exhilaration, excitement' and the like (*f*,<sup>2</sup> p. 29<sup>4</sup>)."

Little stress, however, should be laid upon these relatively infrequent and perhaps ambiguous suggestions of a 'feeling of activity' on the part of Wheeler's observers. On the other hand, it cannot be doubted that four of these six observers often have an experience which they all, and often the experimenter also, call consciousness, or awareness, of self (not specifically designated as active self). The introspectors' records teem with such expressions as "I want,"<sup>3</sup> "I was fond of,"<sup>4</sup> "I asked myself,"<sup>5</sup> "My state of suspense and helplessness."<sup>6</sup> There is frequent reference also to the "I" which is "aware of motor and organic reaction."<sup>7</sup> In the face

<sup>1</sup> Cf. page 372, below.

<sup>2</sup> This letter refers to Wheeler's estimate of *C*, quoted above. In the paragraphs which follow the same method of reference is used.

<sup>3</sup> Pp. 17<sup>2</sup>, 25<sup>2</sup>, *et al.*

<sup>4</sup> P. 11<sup>2</sup>.

<sup>5</sup> Pp. 16 *et al.*

<sup>6</sup> Pp. 12<sup>2</sup> *et al.*

<sup>7</sup> Pp. 18 *et al.*

of all these expressions, Wheeler none the less denies, as has appeared, that his observers actually have an experience of self. The purpose of the following pages is the critical scrutiny of the reasons he gives for this denial.

In the case of two of his observers (*A* and *D*) Wheeler dismisses the alleged awareness of self as a case of mere retrospection, or interpretation. "Both *A* and *D* agreed," he says, "that this awareness was merely retrospective and interpretative and that under these latter conditions the awareness was one which the experimenter suggested by his questions and was not one which was characteristic of their acts of choosing (*b*, p. 31<sup>8</sup>)." It follows, Wheeler infers, that the immediately realized choosing, which in these introspections *A* and *D* were recalling, did not contain any consciousness of self. But this deduction obviously overlooks a second possible conclusion. Though *A* and *D* may indeed have added, in the retrospective consciousness of choices immediately past, something which did not occur at all in the original choosing, yet they may equally well have brought to light in their introspection that of which in the direct experience they were inattentively conscious. This indeed is the recognized function of recall in introspection. Similarly, the questioning of an experimenter may, at least conceivably, serve not to suggest an experience which did not occur but to bring to mind one which did. The fact then that *A* and *D* described their consciousness of self as introspective and interpretative, attributing it to the experimenter's questions, can not prove, even if it suggests, that the self-awareness was not present in the original experience of choosing. Still less is the fact that *A* and *D* were retrospectively and interpretatively aware of self a reason for denying *in toto* the consciousness of self. For retrospecting and interpreting are themselves forms of consciousness. Whether or not, then, *A* and *D*, *in choosing* this or that picture or musical selection, were conscious of self, admittedly *in recalling* or interpreting this decision each had self-awareness.

It may be pointed out parenthetically that Wheeler's objection to the interpretative procedure seems to be purely

to interpretation in terms of self. He accepts, for example, a reagent's interpretation of an experience made up of kinaesthetic and organic sensation with pleasant affective toning "as a tendency to choose the 'Rusticana' title (*e*, p. 11<sup>2</sup>)."  
But if kinaesthetic sensation may properly be interpreted as choice, it seems at least equally proper to interpret as self awareness such a verbal reaction as, for example, "I am in the act of accepting."

It is however unnecessary to protest further against Wheeler's conclusion that *A*'s and *D*'s reported awareness of self, because interpretative and retrospective, has no evidential value. For two other observers, *C* and *J*, assert unequivocally that they are frequently aware of self not retrospectively but in the act of choosing. Wheeler, however, insists, and on occasion both *C* and *J* agree, that this alleged consciousness of self or of self-activity is completely reducible to sensational experience mainly kinaesthetic and organic, that it is "always present to consciousness in terms of kinaesthetic sensations (p. 29<sup>4</sup>)."  
So, observer *E* says: "I was aware of an attitude of doubt or hesitation; this consisted of very unpleasant affective toning of tendencies to frown, to close my eyes . . . ." <sup>1</sup> And *J*'s consciousness that he was not fulfilling a task "was present in terms of kinaesthetic imagery (*n*, p. 14)."

The issue is clean-cut. Are Wheeler and, at times, his observers justified in reducing to entirely sensational complexes the experiences reported in terms of self? Or do the phrases, "I am aware of myself," "I find myself," "I impose on myself," "I choose," and the rest, indicate a distinctive experience, inattentively realized, unreflectively reported and sometimes even formally disavowed by the introspecters? Can we, in other words, find in the introspections proof or suggestion that experimenter and observers alike, biased by a sensationalistic theory, have attended exclusively to the vivid sensational filling of their experience, ignoring their constant but inattentive awareness of the self which has the kinaesthetic and organic sensations? In the opinion

<sup>1</sup> P. 16. Italics mine. Cf. pp. 17 f.

of the writer the introspective records do indeed bear unequivocal testimony to the occurrence of a consciousness of self which the writers do not and could not analyze into sensation-complexes and imagery. This conclusion is based on three considerations.

1. In the first place, as has already been pointed out, phrases constantly recurring throughout these introspections, such as "I found myself," "I must," "I hesitate," certainly seem to show that Wheeler's observers agree with Michotte's and Ach's in finding a self-aspect (*eine Ichseite*) in the volitional situation. To this, however, Wheeler would doubtless object that the use of the personal pronoun in its several forms, direct or reflexive, is a mere convention, a convenience of language from which no conclusion should be drawn. But this position cannot be left unchallenged. For, so long as those who deny that they experience the self claim and exercise the privilege of using language whose obvious meaning is assertion of the consciousness of self, it certainly remains possible that they covertly and unwittingly assume in their analyses of experience the consciousness of self which they formally deny. To state this more concretely: not until Wheeler and his observers describe volitions of different sorts, acceptances of instruction and self impositions, exclusively in terms of sensation, without once falling back on the 'I,' the 'me,' the 'self,' or the 'my'—not till then can they conclusively repel the charge of bringing in by the implication of their phraseology the self whom they directly deny.

2. The critic of Wheeler need not however rest his case on so general an argument as the foregoing. For there are, in the second place, two experiences constantly recurring in the mental processes of Wheeler's observers which he himself formally describes and distinguishes in terms of self and not in terms of distinct sorts of kinaesthetic and organic sensation. To quote his own words: "The acceptance of the *Aufgabe* seems to be . . . in essence a motor response either to the stimulus of self-imposed instructions or of instructions imposed from without (p. 83)." The distinction is

repeatedly made. Wheeler says, for example, that when "the materials for the choice were presented without any instructions, the reagent invariably found it necessary to 'accept' self-imposed instructions" (p. 8<sup>2</sup>); and again; *J* "imposed upon himself the subsidiary task to compare the two alternatives (*p*, p. 24)." But Wheeler never tells us precisely what organic or kinaesthetic sensations occur in acceptance of instructions from without and are lacking in self-imposition of instructions, or *vice versa*. This is the more noteworthy in that he has provided us with a rough classification of the kinaesthetic processes into: "First, tensions in the throat and vocal organs . . . relaxation of facial muscles about the eyes, incipient tendencies to smile and tightening in the jaws; secondly, tensions in the neck or incipient movements of the neck of nodding toward . . . the alternative; kinaesthetic imagery with incipient movement of pointing toward . . . the alternative in question; . . . thirdly, a wave of pressure beginning in the chest . . . and extending upward into the throat . . . ; contractions of the diaphragm and external abdominal muscles; . . . and abdominal contractions, relaxations and 'hollow' or 'sinking' sensations from the region of the stomach and diaphragm (p. 32<sup>2</sup> f.)" Now if the two differentiated types of acceptance of instruction really are constituted by these kinaesthetic and organic sensations, thus classified, Wheeler should be able to distinguish one from the other by some statable regular difference between the sensation-complex which makes up self-imposition and that in which acceptance of external instruction consists. Any such specific and distinctive analysis, however, Wheeler never makes. Rather, he says with engaging vagueness and generality: "To be vigorous or genuine an act of choosing must involve one or more of the above groups of kinaesthetic or organic processes, not necessarily all the items of any one group, but a majority of them. . . . The contents," he expressly adds, "should not follow any fast and definite rule (p. 33<sup>1</sup>)."<sup>1</sup> Indeed, far from distinguishing in sensation-terms these basal experiences,

<sup>1</sup> Cf. pp. 23, 25; and for introspection cf. esp. p. 45.



Wheeler actually differentiates them in terms of self. For 'self-imposed instruction' is of course 'instruction by myself,' whereas 'instructions imposed from without' are imposed by other selves. Thus by the actual fashion in which he makes his own technical distinctions Wheeler belies his claim to reduce the alleged self-awareness in choice to sensational constituents.

3. The final reason for challenging Wheeler's reduction in self to sensational complex centers is the fact that self-questioning is a frequent prelude to his observers' choosing. "Observer *E*," Wheeler says, "very seldom experienced a final decision or a vigorous tendency to choose which he did not delay by the self-questioning: 'Do I really want to hear this?' 'Why do I want this alternative?' (*k*, p. 25<sup>2</sup>)." The records of several other observers abound in similar introspections. A "brief period of suspense" in *B*'s case was "characterized by muscular strains . . . and by a vocal-motor self-questioning 'What am I to do? What do I know about the 'Rondo' selection?' (*c*, p. 9<sup>4</sup> f.)." *D* "asked himself," in vocal-motor-auditory imagery 'Do I really want to hear this?' (p. 16. Cf. *g*, p. 17<sup>2</sup>). Similarly, *F* had the vocal-motor imagery "Which of these do I want?" (*l*, p. 42<sup>2</sup>). And in addition to these cases of self-questioning in verbal terms which precede volition, Wheeler's records contain instances in which the final stage of choice seems to consist not in merely organic-kinaesthetic, but in verbal, that is auditory (or visual) together with vocal-kinaesthetic sensation or image. Thus, the introspection of *A* terminates in "the vocal-motor-auditory: . . . 'Hurry up and present them to me (*a*, p. 5 f.)'" ; and that of *D* in the words "I will take this one (*g*, p. 17<sup>2</sup>)." And *J* is "aware of a long drawn-out, breathy, auditory 'Oh, I want this' (*n*, p. 13)."

Wheeler explicitly interprets these self-questionings, and by implication conceives the final phases of these choices, as a mere series of vocal-motor or motor-auditory sense-complexes. And without doubt the questioning experiences do contain these complexes. But that they are not constituted by the verbal complexes is clear from the simple consideration, ig-

nored by behaviorists and sensationists alike, that a precisely similar self-questioning may be experienced involving radically different verbal terms. For example, if *D* had said to himself: "Qu'est-ce que je sais?" instead of "What do I know?" his experience of doubt would admittedly have remained the same but his vocal-motor-auditory complex would have been utterly different. Now, obviously self-questioning can not consist solely in verbal sense-complexes if precisely resembling questions are characterized by radically different sensational factors. Indeed, only the heavily weighted sensationistic bias of traditional psychology could conceal from any open minded observer the patent fact that the core of the experience indicated by such words as "Do I really want to hear this?" or "I prefer to hear it," is not the imaged sound or kinaesthetic 'feel' of the particular words, do—I—want—hear. Something is experienced here besides the verbal sense-complex; and Wheeler's expression 'self-questioning' certainly suggests that this something includes an 'awareness of self' analyzable in terms of the basal attitudes or characters of the self. In any case, the fact that Wheeler so constantly reduces his observers' self-awareness to verbal terms gravely discredits the success of his attempt to explain away their introspective testimony to a consciousness of self.

#### IV.

The outcome of the study just undertaken of the introspective records of Wheeler's subjects is thus completely to discredit his opposition to the conception of choice as involving a consciousness of self. For these records show that, not only incidentally but in technical description, both Wheeler and his observers unmistakably imply the awareness of self. In the face of this discovery it seems at first sight impossible to account for their persistent denial of the occurrence of such a consciousness of self. But the explanation of the seeming discrepancy lies close at hand. The study of Wheeler's comments on the introspective records shows conclusively that neither he nor his observers really understood the nature of the alleged self-awareness which

they denied having. "In a voluntary choice," Wheeler says, "there is no consciousness of activity as such, no awareness of an immediate and unanalyzable self (p. 51<sup>4</sup>)."<sup>1</sup> And again: "Never did the consciousness of the self or of willing resolve itself into a rigid and fixed synthesis of elemental contents or into any isolated mental content (p. 29<sup>2</sup>)."<sup>2</sup> But these assertions are far from discrediting the view that volition includes a consciousness of self. For none of the psychologists whom Wheeler opposes describe the self as an elemental content and at least one of them, the present writer, has been at great pains to describe the self as complex, though undefinable.<sup>3</sup> In truth, Wheeler's repeated asseverations in maintenance of his thesis, that his observers were never conscious "in elemental fashion . . . of the self," throws the gravest doubt on his statement that they were familiar with the concept of the will as involving self-activity. Rather, the self whose presence they deny, the 'self-element,' is—to paraphrase Spinoza—as different from the complex, concrete, immediately observed self as the dog in the heavens, the constellation *Canis*, is different from a living, barking dog.<sup>3</sup>

On the fundamental point at issue, therefore, the occurrence in volition of a consciousness of self, Wheeler's results really confirm those of Michotte, Ach and their confrères. As regards the specific doctrine that choice is immediately realized as self-activity, the introspective records of Wheeler's subjects, though non-committal, are not incompatible with the Michotte-Ach conception, since the only 'activity' which these subjects deny feeling is once more a fictitious activity-

<sup>1</sup> Cf. p. 28.

<sup>2</sup> Cf. 'The Self in Scientific Psychology,' *Amer. J. of Psychol.*, 1915, 26, 495.

<sup>3</sup> It is interesting to notice that in several cases the 'self-consciousness' which the observers reduce to a kinaesthetic and organic sense-complex, is nothing other than the observer's consciousness of his body. One of the observers, indeed, *J*, explicitly describes the awareness of "my bodily self, involving kinaesthetic sensations, visually localized, about my throat, face, and chest (p. 28)." (Parenthetically it may be observed that *J*'s use of the qualifying adjective 'bodily' implies the existence of a non-bodily, a mental, self. For if every self were a body, a self would no more be called bodily than a cube is called a solid or a square a rectangle).

element.<sup>1</sup> In favor, also, of the self-activity conception is the fact that Michotte and Ach meet a crucial test which Wheeler evaded. As will be recalled, Wheeler does not distinguish specifically different kinds of choice by specifically different types of kinaesthesia but himself falls back on the distinctions of self-psychology.<sup>2</sup> The theory of Michotte and Ach, on the other hand, is specific and not merely general. They do not simply enumerate different forms of choice and assert, in each case, "introspection shows that the feeling of activity was present," but, without recourse to the categories of another theory, they distinguish the different forms of volition from each other. So, for example, Ach distinguishes weak volition from normal volition by the fact that in the former case the emphasized consciousness "I will" is replaced by a combination of the relatively impersonal consciousness "this is to happen" and the relatively inactive awareness "I am ready (*Ich bin bereit*)."<sup>3</sup> And Michotte distinguishes the will proper from adoptive will,<sup>4</sup> contrasting both, as forms of self-activity, with the receptive or inactive consciousness.<sup>5</sup> Further and more detailed consideration of the self-psychologist's conception of will would lead too far afield. The point of the present paragraph is simply that the mere denial by Wheeler and his observers of the occurrence of a 'feeling of activity' can hardly hold against the discriminating introspection of the Michotte-Ach observers. And this is the more true since, so obviously, the Wheeler observers do not mean what Ach's and Michotte's mean by 'feeling of activity.'

<sup>1</sup> It may well be noted that (from the standpoint of self-psychology) Wheeler's own account of choice as made up of kinaesthetic sensation, is incomplete unless it makes reference to the self. For the very awareness of kinaesthetic sensations, so far from precluding awareness of self, really and concretely is the awareness of the self's sensings. In the words of S. Alexander, who certainly is not biased by an over-idealistic philosophy: "Even in sensation it is we who have the sensations ('Space, Time, and Deity,' I, p. 105<sup>2</sup>)." Even, therefore, if Wheeler were right in identifying choice with kinaesthetic sensation he would, none the less, be unjustified in denying the awareness of self.

<sup>2</sup> Cf. page 367 f. above.

<sup>3</sup> *Op. cit.*, pp. 280 ff.

<sup>4</sup> These terms are the writer's, not Michotte's.

<sup>5</sup> *Op. cit.*, p. 195<sup>3</sup>.

In conclusion, heavy stress should fall upon the fact that the positive outcome of Wheeler's study, the experimental demonstration of the occurrence, in each phase of choice, of kinaesthetic and organic sensation, is entirely unaffected by this criticism of his negative doctrine. The truth seems to be that volition includes both awareness of self-activity and kinaesthetic-organic sensation. And as a matter of fact upholders of the self-activity conception have always been of this opinion. So Michotte, for example, whose procedure Wheeler has followed, finds in his subjects' experience not only the feeling of self-activity but kinaesthetic sensation due to head movements, feelings of 'muscular activity' and 'relaxing tension,' respiratory and "articulatory sensations."<sup>1</sup> And Ach's observers record similar sensational experiences, for example, "vivid sensations of strain in the forehead and in the organs of speech" and "strong strain-sensations in the abdomen, larynx and forehead,"<sup>2</sup> as well as the consciousness of the activity of the self (*Betätigung*). *Per contra* the alleged reduction by Wheeler's subjects of self-awareness to sensational complex is often made in terms entirely compatible with the view that volition is a consciousness of self-activity, though it includes the kinaesthetic sensational consciousness. For example: Wheeler's statement that circulatory and respiratory sensations (together with rapidity of attention-shift)<sup>3</sup> "were the basis of any tendency to interpret [*B*'s] experiences as feeling of activity (*d*, p. 30)" is not equivalent to saying that these organic sensations were the exclusive *constituents* of the experience. Again, the statement that choice is 'meant' and fondness 'indicated' by a complex of circulatory, respiratory, stomach, diaphragm and throat sensations (*m*, p. 18) is not synonymous with the description of choice and fondness as *consisting in* these sensations. Even more obviously, to say that kinaesthetic and visual sensations "represented to me that I was in the act of accepting this title (*n*, p. 13)" does not assert that the kinaes-

<sup>1</sup> *Op. cit.*, pp. 194 f, 192, 189 *et al.*

<sup>2</sup> *Op. cit.*, pp. 232 f, 192.

<sup>3</sup> It should be noted that according to the self-psychologist attention is an attitude of self.

thetic sensations constitute my acceptance: rather it implies the difference of the sensational symbol from the actual accepting.

We end, therefore, by confirming Wheeler's facts, but rejecting his interpretation of them. More definitely, we accept the positive results, entirely compatible with each other, both of Wheeler and of the introspecters whom he criticises. The outcome is a conception of the self in volition as both kinaesthetically and 'actively' conscious.

## THE CORRELATION BETWEEN INTERESTS AND ABILITIES IN COLLEGE COURSES

BY EDWARD L. THORNDIKE

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In the July, 1920, number of the REVIEW, Bridges and Dollinger have presented interesting correlations between (A) the position in which a college student puts one of the subjects which he is studying for interest to him in comparison with the other subjects which he is studying, and (B) the mark which he receives in that subject in comparison with other students taking it. The coefficients (of mean contingency) are:—for Psychology, .22; for English, .27; for all subjects in general, .25.

These are instructive facts, but an equally important relation, perhaps, is between (A) above and (C) the mark which he receives in that subject *in comparison with the marks which he receives in other subjects*. By Dr. Bridges' courtesy, his original data have been put at my disposal to compute this.

We obtain for each student a record like this:

Subjects studied	Rank for interest	Letter Grade	Rank for Grade received
a	1	G	2
b	3	A	4½
c	2	G	2
d	5	A	4½
e	4	G	2

The grades are M, G, A, P, and F, in order of excellence; M being highest.

The correlation for any such case is easily obtainable by

$$r = 2 \cosine \frac{\pi}{3} \left( 1 - \frac{3 \sum \text{differences}}{n^2 - 1} \right) - 1.$$

The differences in our illustration are 1, 1½, 0, ½, and 2, summing to 5, making  $r \equiv .58\frac{1}{2}$ .

I have so computed the correlation in each of one hundred and forty cases taken at random from Bridges' data. It varies as shown in the table below, and has a central tendency of .46, very



much higher than the correlation between interest rank within the individual and grade in comparison with other individuals as determined by Bridges. It is lower than the correlation obtained when an individual's ranking of subjects for interest is correlated with his ranking of them for his ability in them as he estimates it. The central tendency of this latter correlation (using the same hundred and forty cases of Bridges) is .70. This again is lower than the similar correlation (.89) obtained by the writer,<sup>1</sup> but using seven subjects of study (literature, science, mathematics, history, music, drawing, and other forms of hand work), for all individuals alike. The discrepancy here is probably explained by two facts. First, the variation in subjects is so much greater in the writer's data. Bridges' data almost never include music, or 'other forms of hand work'; do not include mathematics or drawing in a majority of cases; and often present a list of very closely allied subjects. For example, the subjects for five students taken at random are:

1. Physiology, American History, English, Psychology, German.
2. Physiology, Latin, Literature, Psychology, German.
3. Algebra, Drawing, English, Chemistry, Spanish.
4. Mathematics, Drawing, English, Chemistry, Spanish.
5. History, Psychology, English, Chemistry, Spanish.

Second: Bridges' students reported on the special courses which were being taken at the time. Mine reported on general interest in the subjects as a whole, and over several years. His rankings both for interest and ability are thus 'attenuated' in correlation by chance factors of the special topic studied and the instruction received. It seems likely therefore that the .70 for the Bridges data and the .89 for the Thorndike data agree closely when the general relation between estimated interest and estimated ability is inferred from them.

Returning now to the lower correlation (.46) found when the different grades obtained by a student rather than his estimates are used as measures of his relative ability. Is the difference between this .46 and the .70 due to the student's over-estimation of the resemblance between his ability order and his interest order, or is it due to the chance errors in the grades? There is good evidence that the latter is the main cause, so that the .70 is the truer fact. This evidence is the correlation between (D) the order of abilities within an individual as he estimated *his abilities*, and (C) the order of his grades. This correlation is only a little higher than that

<sup>1</sup> *Popular Science Monthly*, Nov., 1912, and *School and Society*, Feb. 10, 1917.

between his order of interests and the order of his grades; its central tendency is .47, the details for the hundred students being as shown in Table I. The grades tally almost as closely with estimated interest as they do with ability. The order of a pupil's interests as he estimates them gives almost as good a prophecy of the order of his grades as does the order of his abilities as he estimates them. Neither gives a very close prophecy because the distinctions involved are so fine—and because the grade received in a single course is so afflicted with chance error. Widen the distinctions (as by comparing mathematics, languages, physical science, history, drawing and music) and reduce the chance error (as by taking the average mark in four or more courses in each) and the correlation between interest and ability will surely rise considerably above .70.

On the whole Bridges' data seem to corroborate the doctrine of a very close relation between the order of an individual's interests and the order of his abilities. Within the restricted range of a group of rather closely similar studies and subject to 'attenuation' by the circumstances of a single course and teacher,  $r = .70$ . This correlation does not appear to be dilated by a tendency of the students to make their ability ratings follow their interest ratings unduly, for the grades correlate almost as closely with the latter as with the former.

TABLE I

THE RELATIONS BETWEEN THE ORDER OF INTEREST, THE ORDER OF ESTIMATED ABILITY, AND THE ORDER OF GRADES FOR EACH OF 140 COLLEGE STUDENTS, USING THE DATA OF BRIDGES ('20) FOR ONE SEMESTER

Sum of differences in rank $r$	Student's estimate of interest with his estimate of ability	Student's estimate of interest with grade he obtained	Student's estimate of ability with grade he obtained
0 1.00	11	1	1
1 .98		0	1
2 .93	35	7	14
3 .85		12	10
4 .73	42	20	21
5 .59		16	15
6 .41	26	43	35
7 .22		9	11
8 0	16	91	20
9 neg.		9	6
10 neg.	8	4	5
11 neg.			1
12 neg.	2		
Median of the $r$ 's . . . . .	.73	.41	.41
Estimated central tendency correlations . . . . .	.70	.46	.47

## A DEVICE FOR DETERMINING COEFFICIENTS OF PARTIAL CORRELATION

BY CLARK L. HULL

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The need for weighting mental tests with such precision as to secure the maximum accuracy of prediction from a team of them has necessitated a very general use of partial correlation by psychologists. In the past the labor involved in making the necessary computations where more than three or four tests were involved, has been rather formidable. In 1916 Kelley published a set of tables which very greatly reduced this labor.<sup>1</sup> There was such a demand for them however, that the edition was soon exhausted and they are now out of print. Kelley has recently responded to the demand for a new edition of his tables by publishing a monograph or computing chart by which various operations indicated in Yule's formula may be performed much as on a slide rule, leaving only a minor computation to be done by hand.<sup>2</sup>

Since the present method of determining coefficients of partial correlation takes its point of departure from Kelley's tables, it is desirable to consider somewhat their derivation and use. Yule's formula for partial correlation is:<sup>3</sup>

$$r_{12.3} = \frac{r_{12} - r_{13} \times r_{23}}{\sqrt{1 - r_{13}^2} \sqrt{1 - r_{23}^2}}$$

Now the right side of this equation may be broken up into three distinct parts:

$$\frac{r_{12} - r_{13} \times r_{23}}{\sqrt{1 - r_{13}^2} \sqrt{1 - r_{23}^2}} = r_{12} \frac{1}{\sqrt{1 - r_{13}^2} \sqrt{1 - r_{23}^2}}$$

<sup>1</sup> Truman Lee Kelley, Tables: To Facilitate the Calculation of Partial Coefficients of Correlation and Regression Equations. Bulletin University of Texas, No. 27.

<sup>2</sup> Truman L. Kelley, Chart to Facilitate the Calculation of Partial Coefficients of Correlation. Special Monograph No. 1, Stanford University Publications.

<sup>3</sup> Yule, G. U., 'Introduction to the Theory of Statistics,' p. 239.

$$- \frac{r_{13} \times r_{23}}{\sqrt{1 - r_{13}^2} \sqrt{1 - r_{23}^2}}$$

It will be noticed that the two fractions found in the right hand member of the above equation involve no variables except  $r_{13}$  and  $r_{23}$ . And since there is a limited number of combinations of these two variables if taken only to two decimal places, it becomes practicable to compute once and for all the values of the two fractions for all possible cases. With the values of these two fractions tabulated as  $A$  and  $B$  respectively, a coefficient of partial correlation involving two-place coefficients of zero order may be obtained merely by multiplying the  $A$  by  $r_{12}$  and subtracting the  $B$ . Thus Kelley's tables reduce to two operations a formula calling for ten.

It is easy to show that if Kelley's  $A$  and  $B$  functions are represented on rectangular coordinates, the position of all combinations of  $r_{13}$  and  $r_{23}$  which make a given sum, occupy an optically straight line; and that the lines for the different adjacent sums are nearly parallel. Moreover, lines connecting combinations of  $r$ 's making a given difference are also optically straight and nearly parallel. Lastly, the sum-lines intersect the difference-lines at angles not far from  $90^\circ$ . Fig. 1 shows a part of a chart with the various sum- and difference-lines drawn in. It is evident that any pair of  $r_{13}$  and  $r_{23}$  values is determined by their sum and difference, and may readily be located on the chart by noting the intersection of the two lines in question. The distance from the point of intersection to the broken line  $MN$  will be the spatial

equivalent of  $\frac{1}{\sqrt{1 - r_{13}^2} \sqrt{1 - r_{23}^2}}$  or Kelley's  $A$ , and its distance from the line  $ST$  is the spatial equivalent of

$$\frac{r_{13} \times r_{23}}{\sqrt{1 - r_{13}^2} \sqrt{1 - r_{23}^2}}$$

or Kelley's  $B$ .

Now if a transparent stencil with a design such as is represented in part in Fig. 2 be superposed upon Fig. 1 in such a way that the point within the circle at  $A$  falls upon the

intersection mentioned above, the point where a given line of the stencil (as 17) cuts the scale  $QR$  will indicate directly the coefficient of partial correlation required. The numbers of the lines in Fig. 2 correspond to values of  $r_{12}$ . The slope is such that it multiplies the distance  $A$  by the particular

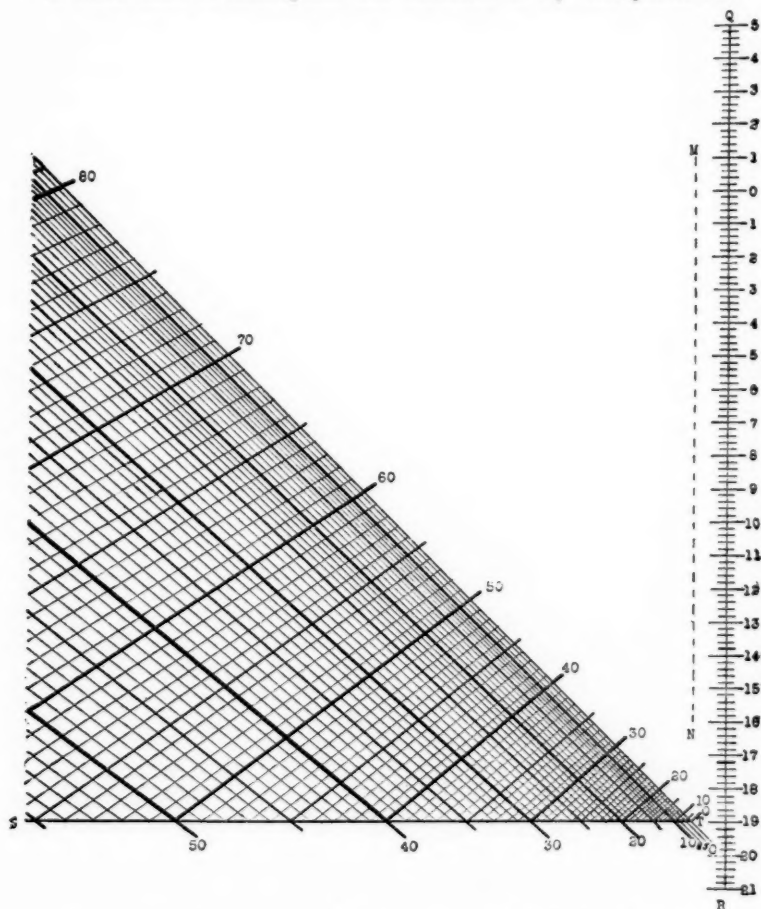


FIG. 1. This shows a sum and difference chart of Kelley's  $A$  and  $B$  functions, together with the scale ( $QR$ ) for reading off coefficients of partial correlation. The numbers on the diagonal indicate the sum-lines and the numbers on the horizontal at the bottom indicate the difference-lines.

$r_{12}$  indicated. And since the distance  $B$  moves backward along the scale  $QR$ , this is equivalent to subtraction. Thus a single setting of the stencil multiplies and subtracts simul-

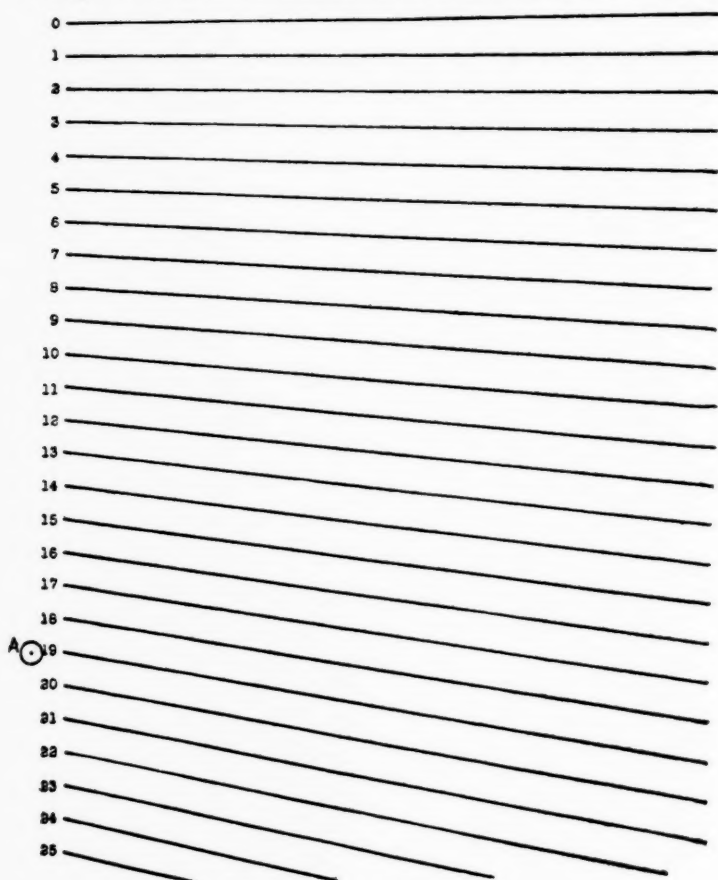


FIG. 2. This shows a section of the transparent stencil that is placed over the chart represented in part in Fig. 1.

taneously with the result that the partial correlation coefficient corresponding to any value of  $r_{12}$  may be read off directly.

In case the  $B$  needs to be added instead of subtracted, as sometimes happens, the stencil is merely turned face down-

ward in such a way that the top of the stencil appears at the bottom of the chart, when the  $r_{12}$  may be read off on the scale  $QR$  as before. In this case, however, the scale must be renumbered, the numbers appearing on the left of the line.

By a method somewhat similar to that just described, the sums and differences may also be read off directly, thus eliminating from partial correlation all computation whatsoever. In Fig. 3, scale  $EG$  and lines  $DG$  and  $FG$  are understood as drawn on the chart, and scales  $AB$  and  $BC$  on the superposed stencil. Now it may be shown that:

$$GH + BH = BJ$$

and

$$GH - BH = BK$$

Accordingly, if  $GH$  represent the larger of two  $r$ 's and  $BH$  the smaller, then the point of intersection of line  $DG$  on the scale  $AB$  will indicate their sum and the point of intersection of line  $FG$  on scale  $BC$  will indicate their difference.<sup>1</sup> It may be noted in passing that the scales  $AB$  and  $EG$  are so made that the readings for both  $r$ 's fall at the same point ( $H$ ) which makes the setting of the stencil very simple. The device represented in Fig. 3 may conveniently be placed on the same chart and stencil with the material previously described.

For zero order  $r$ 's involving only two-place numbers, the sums and differences may also be read directly from a small table. All those likely to be used, those up to  $70 + 70$  say, may be arranged in a single triangular table and placed for convenient reference on a corner of the chart not needed for other purposes.

Both settings of the stencil described above assumed that the stencil is to be held parallel with the chart. This parallelism may be secured by drawing vertical lines on the stencil at intervals such that no matter where the stencil may be placed, one of them will fall close to the line  $QR$  on the chart, thus permitting the eye to detect readily any deviation from the parallel. Intervals of about a centimeter seem to work well in practice.

<sup>1</sup> In case  $GH$  represent the smaller  $r$  and  $BH$  the larger, both sum and difference may be read off directly on scale  $AB$  and scale  $BC$  may be dispensed with.



A second method may be used instead. The chart of Fig. 1 is mounted on a light board of suitable dimensions, which is supported like a little table, by legs about an inch high. Be-

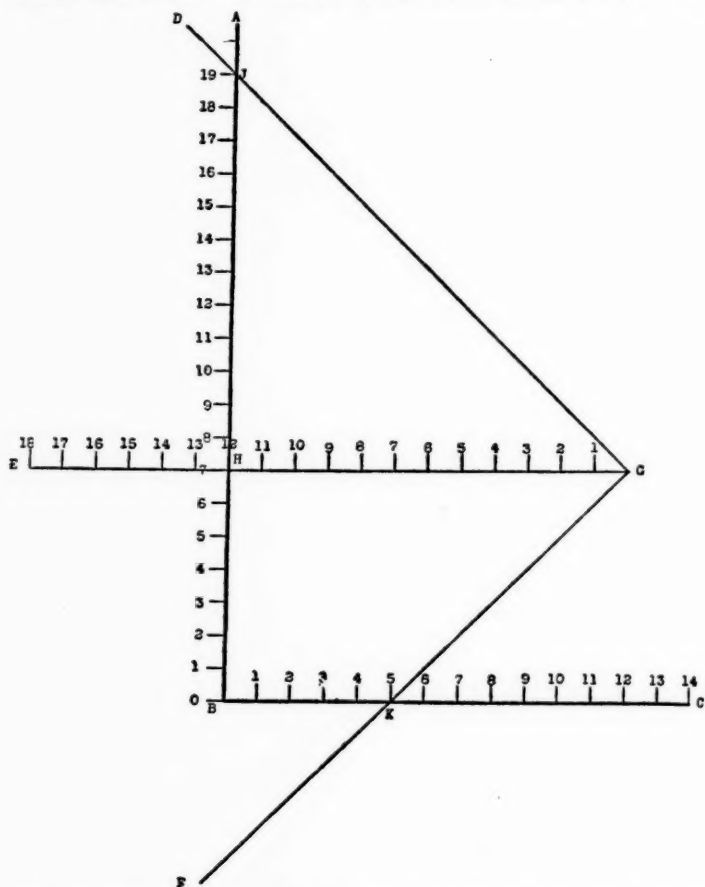


FIG. 3. This shows the addition and subtraction device with the stencil set to give the sum and difference of 12 and 7. The sum is read off directly at *J* and the difference at *K*.

neath the upper right hand corner of this board is attached a light set of steel levers so constructed that anything attached to the movable end of them can move freely within the de-

sired area, yet will always maintain a strict parallelism somewhat after the fashion of the universal drafting apparatus. This movable end of the lever system projects from beneath the right side of the board, extends upward to the level of the stencil and is attached firmly along the right edge of the latter. The stencil can then be moved about freely in all desired positions yet will always retain a strictly parallel position with respect to the chart. But since this arrangement does not permit the turning over of the stencil, an extra set of multiplying lines are drawn on the stencil sloping in the opposite direction, to be used in cases where the *B* must be added. The two sets of multiplying lines make an angle with each other of about 65 or 70 degrees.

Since correlations higher than 75 are rarely met with in mental testing and combinations of two *r*'s making a total of 130 almost never, the charts used by the writer only give sum values up to the latter amount, with difference values to correspond. The latter rarely exceed 50 though the chart gives them up to 80. This makes a chart and stencil each  $20 \times 24$  inches and yields results accurate to about .0005. By its use coefficients of partial correlation may easily be determined in 30 seconds from two-place zero order coefficients, three-place coefficients requiring somewhat longer.

The device is being used regularly in the Wisconsin laboratory in connection with an extensive program of vocational testing. If it seems likely to have a wider usefulness, reproductions will be printed and distributed at cost. In the interim, it is hoped that the above description may enable any especially interested individuals to construct the device for themselves. Both chart and stencil are drawn on the slightly roughened surface of 1/16 inch sheets of celluloid which have been 'frosted' on one side. Such frosted surfaces receive the ink very well. The surfaces are then shellacked rather heavily. This protects the ink and at the same time restores the transparency to the celluloid. The lines on the stencil should be on the under side so as to make as close contact with the chart as possible and thus facilitate precision in reading. Celluloid is used for the chart rather than paper, in order to avoid shrinking and swelling from changes in humidity, which would seriously impair the precision of the instrument.